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Abstract

In August, 1967, a conference was held at the University of Oregon to identify, forecast, and discuss the evolving requirements of educational information systems. The general purpose of the conference was stated as follows: if chaos is to be avoided in educational systems by the mid 1970's, intensive research development efforts in the field of educational system requirements must be mounted. While much has been written about systems requirements, the educational community is in need of a summarizing statement regarding what has been done and what most needs to be done regarding educational information system requirements in the next one to two decades. The general purpose of the conference was to produce a statement, representing the thinking of a select group of educators and information science specialists representing the several sectors of education. The papers in this volume constitute the beginnings of such a statement which has since served as a basis for further dialogue throughout the country and abroad. (Author/CJ)

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Educational Information System Requirements: The Next Two Decades

Papers from a Conference held at the University of Oregon, Eugene, Oregon during August, 1967

JOHN W. LOUGHARY AND MURRAY TONDOW
EDITORS

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College of Education, University of Oregon

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EDUCATIONAL INFORMATION SYSTEM REQUIREMENTS: THE NEXT TWO DECADES

Papers from a Conference Held at the University of Oregon
Eugene, Oregon, during August, 1967

John W. Loughary and Murray Tondow
Editors

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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> "It is not altogether a caricature of our educational system to represent its attitude as saying, 'You will learn what we want you to learn, when we want you to learn it and at the rate at which we can deliver it', The child as an organism, replies, in effect, 'What the hell! I shall learn what I like and when I can'."
>
> (Patrick Meredith)

College of Education, University of Oregon

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Preface

In August of 1967, a group of people representing a variety of disciplines and vocations met at the University of Oregon in Eugene for five days to identify, forecast and discuss the evolving requirements of educational information systems. The general purpose and objectives of the conference were stated in the original proposal as follows.

Educational information system requirements, while always important, have become increasingly critical during the last decade. During the last two years, it has become clear that intensive research development efforts must be mounted if we are to avoid chaos in educational systems by the mid 1970's. The primary pressures are (1) the increasing number of individuals about which educational information must be processed, (2) the expanding amount of subject matter information per se, and (3) the increased specificity of information output requirements resulting from greater individualization and diversification of instruction. The problem affects not only the public sector of education, but the industrial, military, and private sectors as well.

While much is being written about education information system requirements, the educational community is in serious need of a statement which summarizes what has been done and what most needs to be done regarding educational information system requirements in the next one to two decades. Such a statement would serve as a reference point for a much broader dialogue. The general purpose of the conference was to produce a statement, representing the thinking of a select group of educators and information science specialists representing the several sectors of education.

The papers in this volume constitute the beginnings of such a statement. Following the Eugene conference, participants have continued to discuss the conference issues with professional colleagues throughout this country and in other parts of the world. Many of us have attempted to broaden our discussions to include more people from specialties other than our own within education as well as to people in related areas. Some of us have introduced ideas and issues raised at the conference in our classes, and discussion of the issues has influenced the research and development work of participants. Some of the participants have continued the discussion initiated at the conference by mail and mutual attendance at a variety of meetings.

A careful reading of the typescript made of the discussions held at the conference led to our decision not to attempt producing a conference summary. The typescript suggests that each participant took away his own impressions and conclusions, influenced greatly by the background he brought to the conference and the particular focus of his ongoing work and responsibilities.

We would, however, note several impressions which all participants appeared to share. First, we were impressed with the enormity of the effort which would be required to produce a statement which would answer the question implied in the conference title. Each of us discovered that we had somewhat different notions regarding what is covered by "educational information", as a reading of the papers will illustrate. If the concerns of all participants were summed, very little would remain outside the definition. This is true because some of us insisted that we include not only the information required to operate educational programs and institutions, but the information which constitutes the substance of education as well.

Second, we were all impressed with the policy issues related to research, development, and implementation of educational information systems. Not that we agreed on how such issues should be resolved. For example, some stated that a national research and development perspective is absolutely essential for meeting requirements of the next two decades, while others felt that such policy would stifle creative efforts, and that "creative waste" must be allowed. But all were concerned that the lack of policy--or policies--was inhibiting advances in system development.

Third, we were impressed--or perhaps more accurately--reimpressed with the size of the effort required to harness emerging technology to educational information requirements. This reflects both the rapidly changing technology and the many and varied changes in education and its responsibilities. Some felt for example, that in order for a project of the 120 man month size to have an impact, it must be completed in, say six calendar months, rather than two years as would be typical of our current pace. If the latter kinds of schedules are continued, the gap between education and its responsibilities will continue to widen.

Finally, in spite of the many and varied problems entailed in developing educational information systems, we were impressed with the work which is under way. Certainly, requirements need to be stated more specifically, and the ongoing work will undoubtedly help in this regard. It may, in fact, be an essential part of the process of defining requirements, in the sense that involvement in ongoing work increases the number and competency of people prepared to address the problem.

A preliminary report of the conference was published in Educational Sciences, An International Journal, Vol. 2, No.2, February, 1968, Pergamon Press, Oxford, England.

Dr. Thomas Stipek and Mrs. Carol Johnson served as conference staff, and Mrs. Lynn Mortensen prepared the final manuscript for printing. We are grateful to them for their assistance.

John W. Loughary
Murray Tondow
Eugene, Oregon

Conference Participants

Fourteen participants were asked to prepare background papers for the conference. Their papers constitute the major part of this document.

Conference participants with current positions indicated, were as follows.

Harold Abel, Associate Dean, School of Education, University of Oregon, Eugene, Oregon.

Lowry Bennett, Director, Project OTIS, Eugene, Oregon.

Bertram Berenson, Director, Department of Architecture, Hampton Institute, Hampton, Virginia.

Richard DeLancie, President, URS Corporation, San Mateo, California.

Thomas Drysdale, Director, Instructional Services Division, Directorate for Dependency Education, Washington, D.C.

Leslie Elliott, Regional Editor, Harper and Row, Publishers, New York, New York.

Thorwald Esbensen, Assistant Superintendent, Board of Education, Duluth, Minnesota.

Frank Farner, President, Federal City College, Washington, D.C.

Arthur S. Flemming, President, University of Oregon, Eugene, Oregon.

R.J.R. Follett, Vice-President, Follett Publishing Co. and President, Instructional Systems Corporation, Chicago, Illinois.

Ralph Gerard, Dean, Graduate Division, University of California, Irvine, California.

Keith Goldhammer, Dean, College of Education, Oregon State University, Corvallis, Oregon.

Sidney High, Division of Adult Vocational Research, U.S. Office of Education, Washington, D.C.

Paul Hood, Program Director, Far West Laboratory for Educational Research and Development, Berkeley, California.

Patrick Meredith, Professor of Psychophysics, University of Leeds, England.

Leo Molinaro, Vice-President for Continuing Education, The University City Science Center, Philadelphia, Pennsylvania.

Donald Pollock, Acting Head, Information Systems Branch, Mathematical Sciences Division, Office of Naval Research, Washington, D.C.

Murray Tondow, Director of Information Services, Palo Alto School District, Palo Alto, California.

John W. Loughary, Associate Director of Research, Division of Psycho-educational Studies, School of Education, University of Oregon, Eugene, Oregon, Conference Chairman.

EDUCATIONAL SYSTEM REQUIREMENTS AND SOCIETY

by John W. Loughary

As you read what follows, I am going to ask that you view education as a complex information system. This, to some, may appear too objective and to overlook the human factors in teaching and learning. I hasten to acknowledge that there are many other perspectives available, and each serves a particular purpose. Our purpose during this conference is to develop a statement of the information system requirements of education, and while this should not - nor cannot - be done without regard for other aspects of education, anything which we can do to help maintain our focus should be helpful.

My purpose is to mention briefly several emerging changes in both society and education in general, and then to point up some of the emerging educational information system requirements. Several assumptions are basic. These include the notion that in order to capitalize on educational systems as a national resource for helping solve society's problems, the education systems themselves must undergo radical changes, and soon. A major aspect of change will be the improvement, and in many instances, the creation of educational information systems. Further, it should be understood that traditional fiscal and indexing systems are only part of the concern here. More important are those systems which are part of instruction per se.

Major Social Changes

It is clear that our culture as well as most others in this civilization will undergo drastic and far reaching changes in the next several decades. Some changes will result from man's attempts to improve his environment directly, and others will represent concomitants of such purposeful change. For example, we purposely employ technology to reduce our work week and increase the standard of living, and to the extent that we are successful, we render many of our traditional institutions (e.g. marriage and family, and public transportation system) less effective, thus creating the need for further changes.

Of the many areas of social change which could be discussed, three have been selected here because of their particular impact on education generally, and the implications for educational information systems specifically. They are first, problems stemming from the population explosion and redistribution; second, implications of new technology; and third, man's changing relationship to man.

Population

Perhaps most basic among changes in society is the increase in population predicted for the next several decades. A conservative estimate indicates that the population of the U.S. will increase from 193 million in 1967 to 244 million in 1980, a growth of 51 million, or over 25 per cent in 12 years. In regard to increased school enrollments, predictions indicate that the increase in enrollment from 1960 - 1980 will be approximately 23 per cent for elementary schools, 53% for high schools and 304% for colleges. The across the board increase will be 43%.

This, of course, is only part of the picture. To complete it, add the number of adults who will be retrained by industry, government sponsored compensatory education programs, and the extension of schools to four, three, and perhaps even two year old children. Finally, add those who enroll in some kind of school, not because their job or age requires it, but simply becuase they have the time and desire to learn. Among the many problems which can be anticipated are the following.

system breakdown

First, many of the present methods (institutions and systems) for meeting the needs of the 193 million people who now live in this country will be ineffective by 1980. As is the case with machines, many social institutions have limited capacities. To carry the analogy further, they can only be expanded to deal with a certain capacity before economic considerations and difficulties of operation render them undesirable. The alternative to basic change is to operate them to their effective limits, in which case an increase in population causes inequities in services. Some of our social systems, of course, have already undergone significant adjustments. For example, some states recently reapportioned in order to reduce inequities in governmental representation, and in industry new machines have been invented to handle volumes which older ones could not. In both examples, however, what begins as a minimum change, eventually evolves into the development of new systems involving new concepts and values. Not infrequently new systems become operational before the changes in values age generally recognized. In any event, in many areas of society, it will no longer be feasible to add to existing institutions. It will be necessary to reorganize old ones and create new ones.

science and human problems

A second kind of development stemming in part from the population explosion is the increased use of science as a tool for solving "human problems". For example, the regulation of family size and curbing the population explosion historically relied on moral control, assisted by rather unsophisticated birth control devices. The point to be made is that the problem, first defined as birth control, now viewed from a scientific frame of reference, becomes that of controlling the fertility rate. While the goal remains unchanged, a much more basic method, in the scientific sense, has been created. This more effective solution to one problem. however, gives rise to another. While both the older and younger "generation" accept the "better" solution, the former continue to associate it with a moral issue, while there is strong indication that the latter do not. The resulting weakening of this social control vehicle, at least from the perspective of the older generation, results in serious misunderstanding between parents and children. Science as a tool applied to "human" problems has many other ramifications. For example, medical science is now able to prolong life and the productivity of many men and women, but it may also overcrowd institutional facilities with completely disabled individuals whose death has been artificially delayed. The new power to control life and death is such an awing moral-value question that there has been little intense effort to answer it.

natural resource management

The impact of increased population on natural resource management and development is increasing. In the past, quantity has been the major concern, a requirement which technology in great part has been able to satisfy. Of equal or greater importance during the coming years will be the qualitative aspects of natural resources, particularly air, land and water. Use or abuse of natural resources will be dependent not upon technology and quantity alone, but on social inventiveness and basic research in management and policy making as well. Resource projections for 1980 emphasize the importance of institutional management and policy experimentation such as the Water Resources Planning Act which allows for diversity in institutional approaches to solving the water resource problem within the United States. The problem, of course, is much more complex. As a member of the world community, affecting and being affected by other nations, natural resource policy, to be ultimately meaningful, must include an international perspective.

distribution of people

The fourth concern related to the population explosion is the change in distribution of people among metropolitan, rural, and urban areas. It has been estimated that by 1980 another 10 per cent of the U.S. population will be living in metropolitan areas. About 60 per cent will live in suburbs. While the per cent of change is significant in itself, the added numbers of people (51 million increase in population) is staggering. Assuming the predictions to be accurate, as many cities will need to be built in the next 15 years as were created in the first 200 years of the United States. City planners and political geographers emphasize the word build, and caution not to confuse build with enlarging existing cities. They make the additional point that because almost random and frequently inappropriate "adding on" to cities is the practice, rather than following plans derived from well conceived policies, cultural stratification and crystallization have taken place in the major metropolitan areas.

It is also predicted that the Negro population will continue to move to the metropolitan areas of the North and West. The implosion which results from an exodus from the city of the more economically well-off, has left ghettos of not only ethnic groups but also those consisting of poverty-stricken people within the less desirable areas of the central city. To prevent the creation of even newer forms of discrimination which can result from such implosion, governmental policies and societal institutions in the metro-system must be reorganized.

Technology

The second general area of concern is the growth of technology, and its application to more aspects of the economic, political, and social sectors.

work as a way of life?

Technology will not only aid the increase of the gross national product but will also continue to change the quantity and quality of the labor force. There will be less need for unskilled labor. An increasing number of the population will be engaged in activities in the service sector of the economy, working fewer hours per week in occupations which are white collar in nature, and at pay levels which historically have been regarded as those of the economic middle class. At the same time, there will be a demand for more people with professional training in humanities, science and management. Unless there is an offsetting expansion in production of new and improved goods and services and an opening up of new markets, technological unemployment can occur.

Basic to such developments for both society and the individual, is the changing function, and therefore, value of work. Historically, work---performing a job, having an occupation---was the individual's means of obtaining the goods and services offered by society. It also consumed most of his energy, and became his "way of life". As long as available goods and services fell short of the demand, work was a reasonable and effective means of determining who got what. Once reaching the point where the actual or potential supply of services and goods is equal to or exceeds the demand, the value previously ascribed to work becomes meaningless, at least in cultures professing to man's concern for man. Work remains important, both economically and personally, for a variety of reasons, but it is unreasonable to deny services and goods to an individual when plenty are available.

The belief that one's job (occupation) can provide a financial income as well as a major means of satisfying and utilizing one's aptitudes, competencies, and interests will become unrealistic for an increasing proportion of the population.

I would like to make it clear that I am not substituting the job-vocation distinction for the traditional vocation-avocation concept. I mean the difference to be more than a semantic one. Webster defines avocation as "something one does in addition to his regular work, and usually for fun", and vocation as "any trade, profession, or occupation". Historically, most people have derived their personal sense of importance, well-being, or purpose in large part from that thing they did to earn a living--namely their vocation. Most people also carried on some kind of avocational or recreational behavior. My contention is that an increasing number of jobs will not serve this dual function (income and purpose), and therefore an increasing number of people will need to:

(1) Hold a job for purposes of earning a living,
(2) Engage in recreational or avocational activity in order to relax and have fun, and
(3) Carry on serious work behavior of a more complex nature than their job or recreational activities in order to achieve a sense of purpose and self worth.

For many, one kind of activity might well satisfy all three types of requirements.

I do not wish to continue the job-vocation terminology if it is confusing, but neither am I willing to settle for the vocation-avocation distinction because it misses the point.

Further, I am not suggesting that work is losing its value in our culture but rather that its value is changing. We have already reached a point where work, defined as a job, is not a way of life for everyone. Those who doubt this should spend some time talking with an educated truck driver, stamp press operator, mail carrier, or card punch operator, for example. These jobs are not a way of life for many who hold them. They may be acceptable ways of making a living, but little else from the point of view of the individual.

The failure of education to make this distinction, and to persist in assuming that each student can find a job which will also provide a way of life, satisfying all the needs which that implies, is simply not consistent with the real world in which we live, and is a major obstacle to modernized education.

technology and personal decisions

Technology will also have a great impact on personal behavior, primarily through increasing exposure to instant communication and nearly instant transportation systems. As a result, many functions about which the individual now must make daily decisions and value judgments will be made for him. The lessening of feelings and hunches as a basis for such decision and the greater reliance on scientific probability data will change significantly the individual's daily personal life. Such questions, for example, as whether to extend his indebtedness, which house to buy, how to plan for his children's education, in effect will be partially taken out of his hands, and assigned to highly sophisticated information systems designed to base decisions and recommendations on a complexity of personal as well as group considerations.

power and technology

A basic characteristic of a technological society is that a minority of the population are responsible for its administration. The result is a power structure involving a gap in communication between a powerful few and what could be the powerless masses. At the same time, electronic advances in communication systems and the ability to store and retrieve and transmit the growing amount of knowledge could be the means for closing that gap.

Man's Relationship to Man

There is another set of problems associated with technology which deserves special treatment. These are concerned with new demensions and requirements of individual and international relations, and result directly from the tremendous impact of the information explosion produced by new technology.

Technology in this culture provided a means by which a large majority of the population has been able to achieve security in regard to necessities such as food and shelter. Indirectly and directly it will continue to have an influence on the types of hopes, expectations, and assumptions held by people, and on the time which it takes to achieve these. Technology has in this manner changed man's environment, and man's relationship to man. It has increased material wealth and security for a large majority of our population. The "new" generation does not have the preoccupation for attainment of economic security characteristic of the depression generation of the 1930's. They seek more intrinsic goals such as civil rights, social justice, and the ending of poverty. In a sense, the new generation of America is a minority in a largely poverty stricken world. At the same time many other nations, while not as advanced technologically, have been part of the information explosion, and while not able to compete, at least are aware and can communicate with more fortunate nations and aspire to their conditions.

One of the important indirect results of the application of technology to everyday human functions in this and other Western cultures is that altruism or at least an altruistic-like attitude becomes a matter of survival and must be part of foreign as well as domestic policies. In essence, altruism, the making of a less ugly world, may become one of the necessities such as food and shelter, for national survival.

To compound the problem, the rate of change in the past was largely controlled by knowledge learned by relatively direct experience and passed from generation to generation. Technology has reduced the time element so that now the dimensions of knowledge are also reduced in time and and expanded in scope, thus producing a vast amount of continuous and rapid change.

One additional aspect of change in the nature of human relations, resulting in part from technology, is worth noting. The difference in attitudes and values between generations has always been a source of frustration for both the old and young. In a sense, however, the different perspectives separated by 25 to 30 years has had a stabilizing influence on cultural change and development. It helped to maintain the pace of change at a relatively slow rate, at least slow enough to allow most of the prior generation to learn to adjust and to live with, if not completely understand and accept, the way of the new generation. As a result of the information explosion, the natural regulator of age has become increasingly ineffective. Instead of the attitude and values of the 1900's versus those of 1930's, it is the young adult of 1967 confronted with the teenager of 1967. The lines of separation are far from clear, but the evidence suggests that at least in this culture, society has within-generation communication issues at least as important as the between-generation conflicts of the past.

In brief, I have attempted to illustrate the point that within the next two decades many institutions of society will undergo changes not only in degree, but more important, in kind. Not only will old problems become more demanding, but new ones will emerge requiring relatively rapid and innovative solutions. The implications for education viewed as a national resource to meet these demands is the subject of the next section.

Major Educational Changes

While I doubt the total accuracy of Orwell's predictions for the 1980's, there is ample evidence that much of what he forecasted will come to be. I have attempted so far to identify certain of these conditions. In brief, the next two decades will bring about a society in which:

1. Personal and national survival will require if not a world citizenship perspective, at least a working awareness of world conditions and the elimination of the traditional procincialism of education,

2. Many personnel responsibilities and tasks will be performed either in total or in large part by complex automated systems,

3. Many individuals will need to engage in relatively serious non-occupational and non-recreational activities as a source of self-fulfillment,

4. Information and knowledge will be less stable, that is, many areas of information will be replaced in relatively short periods of time,

5. Information will have a much more important function as a basis for decisions.

It appears obvious, at least to me, that a chief means of survival in such a society will be access to an effective educational system. What are some of the characteristics of such a system?

First, its organization or structure must cover man's total life span. Its components should reflect educational functions, rather than arbitrarily determined age groupings and other environmental conditions incidental to the goal. For example, computer programming might be the subject of instruction for both a thirteen year old girl and a forty year old man. One might be enrolled in a public school and the other preparing for a new job in a company. These educational needs, however, are quite similar in the sense that the teaching vehicle for one, ought to serve the other, if not directly, at least indirectly.

Second, individualized instruction will become a necessity rather than a luxury. Because of the great number of people to be taught, the great variety in their backgrounds, and the necessity to provide instruction when the learner needs it, the traditional class and classroom model will have to be replaced. The learner must be able to begin when the need occurs, and at the place and pace most appropriate for him. In part, this means that there must be much greater learner participation in the selection of objectives and procedures.

Third, education will become more dependent upon large support systems, especially those concerned with instructional resources, information storage and retrieval, multi-media instructional packages, and systems which bring the environment or subject or concern to the learner on something like a real time basis.

Fourth, the instructional process will have to "make sense" in terms of perceived applicability to a greater variety of individuals. While learning may not ever be easy for all, it will have to be enjoyable and relevant.

Fifth, the availability of education will have to be increased in the sense of informal media. Even given the learning centers concept which many have suggested, the availability of educational resources at home and at work needs to be increased.

The list could be much longer. Perhaps what is most basic in regard to educational systems needed in the near future, and almost a prerequisite to all other developments, is a basic revision in our concept of education. Education has been viewed as having definite starting and ending points, and obviously it doesn't. But the learner has been led to believe that it does. We have seen education as a preparation for ensuing behavior, and obviously, it is more than this. It is both the preparation and the ensuing behavior.

Others have suggested that education needs to be life long and there is certainly no quarrel here with that. One learns something in each experience regardless of the extent to which it was designed or perceived as educational. However, an equally important part of the idea, and one which I believe needs more consideration, is that education must be thought of as whatever one does to solve a new problem, meet a new need, or as a matter of fact, any behavior directed at a new goal. If this concept is accepted as valid, then the multitude of out-of-school educational resources can be designed and used with greater specificity of purpose. They can also be related and extended to in-school education in a more useful and meaningful manner.

One important implication is that the concept encourages us to cease giving so much attention to the individual's responsibility to "get an education", a truly impossible task. Rather, he would view - eventually take for granted - each new thing he does as education. Education, in this sense, is a process. It is not something which one obtains, but rather something one does better as a means of achieving whatever purposes he may have. The consistent goal, whatever the specific nature of the purposes for an individual, is self development.

Educational Information Systems

The vehicles which move the process of education are educational information systems. Historically, such systems consisted entirely of humans - two part human systems - the teacher and the learner. Non-human components were added, such as pictures, books, moving pictures, combinations of these, and recently automated data processing systems. The systems originally operated with little environmental support - a log under a shade tree sufficed. Eventually buildings were added and finally, physical plants.

The teacher was originally an amateur artist, and now a highly trained specialist. The learner, who originally gave no direction to the process, recently has demanded and acquired at least minimal influence on how the system operates.

In spite of the tremendous growth in size and complexity of educational information systems - their hardware, personnel, and operating procedures - they continue to be based on "log under the shade tree" concepts. Their specifications - the requirements assigned to them - in most cases reflect the minimal survival requirements of ancient times, and are in some areas totally inappropriate to the 1970's, let alone the 80's and 90's.

Some argue that this contention is absurd - that Western man, at least, enjoys a better life than ever. He is better educated, then why does he permit a Korea, a Viet Nam, a Watts,a Detroit? These, it must be admitted, in spite of the complex explanations and moralizing which have gone on, represent down right stupid behavior. Both as individuals and groups we demonstrate stupidity in bringing about such events and in failing to resolve the related conditions. Why do educated people engage in stupid behavior?

Part of the answer, in my opinion, is that requirements for educational information systems have been inadequate, irrelevant, and even missing in some instances. Rather than specifying requirements in terms of the objectives of education, we have viewed and accepted the specifications of existing systems as if they were in fact adequate requirements. Education, at least public education, has a history of "making do" with what it has in hand, with apparent disregard for the changing world. Fourth grade pupils in Oregon, for example, still devote the better part of nine weeks to studying Indians of the Northwest. The emerging nations of Africa, in contrast, queue up until grade nine.

The task of this meeting is that of adding clarity to the requirements of Educational Information Systems. It is a difficult assignment, and one to which others in similar meetings and alone will address themselves. My basic goal is that our deliberations will contribute to this greater dialogue.

THE NATURE OF EDUCATIONAL INFORMATION

by Murray Tondow

My remarks this morning fall into four general areas. The first is an overview of the areas of information and education. This will be followed by a somewhat more detailed discussion of information and a position concerning the structure and grammar of information. Then I should like to discuss with you a bit about education and information today. And finally I would like to address myself to some remarks concerned with the coming decade in education.

I. Overview

The purpose of this conference is to look ahead. Therefore I should like to attempt a description of educational information in a somewhat different manner. This approach is not in conflict with the traditional parameters of educational information, but rather it is a qualitative extension. My purpose is not to demean: I do not think today's approach can meet tomorrow's demands.

The basis for educational information at present is rooted in administrative convenience. For example, one talks about instructional information, personnel information, business, pupil personnel, administration information, and so forth. This structure is related to the organizational chart found in most institutions, and, as such, represents a convenient way to group data in relation to the existing organizational pattern of the institution in particular and of education in general. I feel that what is strongly needed is a theoretical basis for information - quite independent of such organizational constraints. It seems to me this is especially critical if we are to view education, in the long run, as essentially an informational system. And it does seem to me that the social, political and technological vectors of today's world indicate that education, more and more, needs to be viewed as an informational system.

I have not lost sight of the over-riding importance of social and individual values. However, these cannot develop in a vacuum. They need an informational and experiential base: they need formal educational structure. It seems to me that we will be called upon increasingly to supply the information systems necessary for such individual and social development. It goes without saying that those aspects of skill that require training (the aspects of one's development which are related directly to skill and training) are also inextricably tied to an informational base. To move information from our present pattern of administrative convenience to a more functional structure - one quite independent of organizational constraints - requires a climate for success: the time must be right, the need manifest, and the people and the tools available. I believe these conditions exist today.

My observation of the history of science leads me to view the scientific development as a "push-pull" procedure. That is, there are periods of time when mans' questions outstrip our capability of attacking the problems. Thus we turn our energies from the questions to the development of adequate technology so as to be able to answer the questions that we have posed. At other times the technology outstrips our capability of asking potent and relevant questions. I believe that we are in such a phase now. We have developed technology (primarily in the computer sciences) to a point of capability which our questions have yet to fully tax. New approaches must be formulated. I do feel, however, that we are beginning to phase into a changeover. That is, I think we are beginning to ask the questions that will soon tax our technological capabilities. Conferences such as this, it seems to me, play a very critical role in seeking just such a balance.

My remarks, then, this morning will relate to an operational definition of educational information; the interaction of information, education and technology. I should like to raise some problems and challenges manifest in this point of view and hope that we might address ourselves to some of these points during this gathering. It is hoped that some description of educational information - whether agreed to or not - can give us an instant base for communication here at the conference. Since we do represent a broad spectrum of interests some set of definitions might help us in our search for instant communication.

II. Information

My attempt here is at an operational definition focused within the interest parameters of this conference; namely educational information. To my knowledge there is no general definition of information. Shannon's work is limited to engineering aspects; he measures but does not define. Weaver and Hayakawa go further and relate information to how it influences behavior. This is a position that I, personally feel more comfortable with, particularly in light of some of my own recent research in the area of man-machine systems.

My thesis, briefly stated, is 1) Information is not a single factor. 2) It cannot stand independent of an ecology. 3) Information must be perceived as a system if it is to have any redeeming social or scientific qualities. 4) As a system, we then see information as a number of variables that have many interactions with different levels of interdependency. Further, these interactions produce a synergy which is fed back for purposes of system modification. 5) There is one added facet which should belong to any system. A goal. I mention this point because I am distressed at how little one sees in systems literature of this matter of goal. 6) A specified outcome is essential. It is the basis for meaningful assessment of the system. At times, in the evolution of any system, a mutation is called for. Without clearly articulated goal definitions this mutation merely becomes infinite random perpetuation without any particular meaning. This random behavior is further clouded by increased efficiency of the system - toward no end. 7) I would like to push the concept of "goal" one step further. A goal can be defined only after values are clarified. A systems goal must be attainable. An ideal may not be possible; therefore, a goal is viewed here as a functional compromise between reality and the ideal. Thus, a system (today, information systems) must ultimately be measured against whether it moves toward or away from some value. The point here is that a system cannot be independent of a set of values, and that information - i.e., information systems - cannot be assessed independent of values. At this point the system becomes very close to what we call science; since the basis of all science is an agreement, a statement of faith, a belief - such as, an inch is an inch. 8) I didn't mean to belabor the point concerning the need for values, but I do get hung up on the semantics of the term, "information". It is viewed as being neutral - independent. But if one looks at the history of science, a neuter social position usually results in scientific stagnation and/or social chaos. And here, at this conference, concerned with educational information, the essence of its relevance seems to be related to its social significance. 9) For the past several years I have been concerned with attempting to develop a general theory of information. For our purposes, at this conference, I would like to limit my comments to a possible structure and grammar of information. I see the structure of information as a three-dimensional model (Figure I): the three broad rubrics being input, process and output. The variable list related to each of these aspects are, of course at this point, tentative. Under the dimension of input we have numeric and semantic. Under the dimension of process we have convergent, divergent, combinative (this is where data may be combined without requiring a new configuration from the basic entity), reconfigurative, and finally, new (this means were additional data has been added which is not combined or part of any other data). Under output we have a unit and a system.

Within this structure the various factors operate. These factors may be presumed to be the grammar or the rules under which all aspects of the information model proceed: 1) Quality of information (relevance, organization, etc.) 2) Quantity (too little, too much, etc.) 3) Accessibility (speed, cost, security, etc.) 4) Reliability (noise, maintenance) 5) Operants (statistics, storage, program protects, etc.) 6) Dissemination (retrieval, organization, mode, etc.)

These factors are sufficiently precise to be measureable. Each has its impact on the effectiveness of the information. As one looks at these factors, it is obvious that the information system described here is essentially computer dependent.

IV. Education

One characteristic of the world today is the increasing impact of technology. A single result of this present day force has been to change the character, or rather move the character, of education more and more toward a man-machine system. Technology now makes an educational information system of the type previously described possible.

It seems to me that at present one of the best procedures for us to follow to increase the sheer power of education to produce positive social gains is to work toward and learn how to relate information through the computer sciences to the individual. Indeed, I am convinced that we are at a point where one of the best measurements of the quality of an educational institution is its computer power. The capability of an institution to individualized, to offer accurate and relevant information, to have flexibility of organization and to have a posture toward change all requires, and is dependent upon, its computer capabilities. This does not mean that computers alone determine this, of course. However, it is to say that the computer is essential to these conditions but not sufficient unto itself. I know of no first-rate school system without some computer capability. And I know of no first-rate institution of higher learning without a sizeable computer configuration.

At this point, it seems to me wisest to perceive education as part of the behavioral sciences. The behavioral sciences are the critical sciences if the world is to survive. Technology cannot assure us of survival but a more rational pattern of behavior can. How man behaves cannot be separated from information. That is, each event (or stimulus) is abastracted to an information form and, as such, operates on the individual effects behavior. I speak here of all behavior - cognitive and affective.

The institutional nature of education is such that its role in the behavioral sciences must be major. What I have in mind here is that schools remain the primary social institution for all societies save the most primitive.

If we are to experience a major break-through in the behavioral sciences, it seems to me we must first know more about "how" one operates: that is how we handle the stimulus (information). Thus, it seems to me that the concern and study of information systems become critical.

III. The coming decade in education

Within the framework of today's technology it seems reasonable to expect that within ten to fifteen years there will be a world-wide educational system. The basis will be satellites, lasers and computers. With this capability of information storage being universally available, it seems to me that it is quite possible to cause a quantum increase in the educational level of the world. Within this framework, education (or its informational base) may be perceived as a utility network. This, then, requires the closest cooperation and interaction between industry, government and the sciences.

While the possibility for a world-wide educational system is quite feasible within the next decade or so this does not, of course, assure us of its coming. There are serious problems concerned with change that must be attended to. One of the major drags on change, of course, are the institutions themselves; that is the pressure within any institution (whether it be private or public) to perpetuate itself essentially in its existing form. The second major area is that of the changing roles of people. With the limited modifications that we have experienced in education thus far, we are already assured that changing the role of the educator is by no means a simple or quick task.

With these problems, it seems to me, we have some moral issues that must be concerned with; one is a much better articulation of our value systems - both from the point of view of the individual as well as from the institution and society as a whole. The social process has been defined as, "individuals seeking values through institutions utilizing resources". It is clear, from this statement, that when there is any imbalance between any of the parts (individual versus institution, or resources available) a great deal of stress and strain is put on the entire social process and that what may start out as a move for change and progress may, indeed, result in regression and chaos. The need for continual feedback and balance is obvious to us all, I believe, as witnessed by the events in our own country as well as the world at large.

Another area, it seems to me, that we need to be concerned with as it relates particularly to the computers and to information, is that of privacy. The threat to privacy reaches the very soul of each of us. I don't quite know how we attend to this problem but perhaps we need to write programs which include algorithms for compassion. In any case, the present day safeguards concerning information stored in computers is totally inadequate. I submit that neither the laws nor mores nor the technology offer sufficient safeguards; all the words spoken thus far notwithstanding on the topic.

And finally can we prove the relevance of this effort? I am concerned that things get done because we can rather than because they should be done. Can we show that information systems are capable of assisting in solving major problems of our time. I believe so - but I can't prove it. But we can move in that direction if we shift from concern about where the computer sciences are taking us to where we want technology to take us. I hope that our discussions during these next few days will touch upon this.

I am aware that my remarks have raised questions rather than offered answers. That was my purpose.

STRUCTURE OF INFORMATION

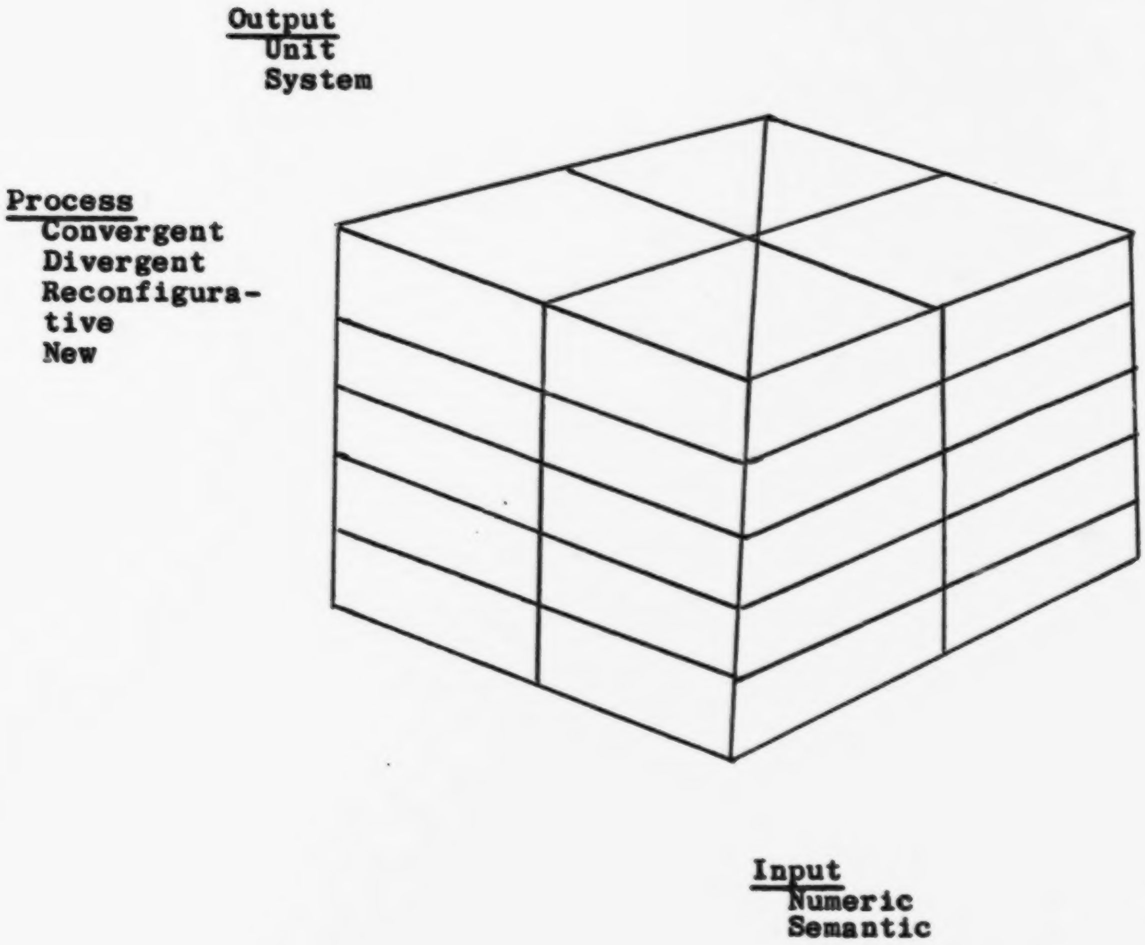
Output
Unit
System
Process
Convergent
Divergent
Reconfigurative
New
Input
Numeric
Semantic

Fig. 1

EDUCATIONAL OBJECTIVES AND THE CURRICULUM

by Thorwald Esbensen

"It is my prediction," says R. Louis Bright, Associate Commissioner for Research, U.S. Office of Education, "that within another ten years almost the entire academic portion of instruction will be on an individual basis in most schools."

If Mr. Bright's statement turns out to forecast correctly the coming shape of American education, it is my prediction that this development will have been supported primarily by a new breed of educational objectives. The "new look" in instructional aims will depart sharply from the traditional North-Central Accreditation variety of educational goals. No longer will it be sufficient to speak generally of such things as "understanding", "comprehension", and "appreciation". To be sure, these words point to worthy ends. This much is not in question. The trouble is: We are left in the air by statements of aims that do not indicate what observable events will represent accomplishment of those aims. They do not permit us to know how well we are doing whatever it is we are trying to do. It is in this sense that the traditional formulation of educational objectives is inadequate.

Putting the quality of subject matter content aside for the moment, an adequate educational objective should provide the following information: It should tell us in the clearest possible way exactly what it is that the student who has achieved the objective will be able to do. It should set forth (whenever it makes sense to do so) the conditions under which the student will be expected to accomplish the objective.

Some examples are in order.

Here are two statements of an educational objective. Which one is expressed in terms of observable student performance? (I am indebted for these and other examples to many teachers, both within and without the Duluth Public Schools, for their efforts to improve the specificity of educational objectives.)

A. Given three pieces of paper of any size, the student will be able to cut a circle from each piece of paper and place these circles on a surface with the smallest circle to his left and the largest circle to his right.

B. Given fifteen statements concerning the peace settlement at the Congress of Vienna in 1815, the student will be able to understand which ones relate to the concept of legitimacy and which ones relate to the concept of balance of power.

Statement A says what it is that we could observe the student doing or having done. The student, we are told, will cut three circles, then place these in a certain relationship to each other. Cutting and placing are observable activities. And, in the case of this particular objective, they suggest a tangible product: Three paper circles in a specified arrangement.

Statement B starts out as though it means business, but soon fades into the vagaries of that state of bliss called understanding. What is it that the student will be able to do because he understands? We are on tiptoes with curiosity. Yet we are told no more. The objective grows mute. Presumably, the student is going to do something about these fifteen statements. But what? Punctuate them? Read them aloud? Re-write them?

This judgment may seem too harsh. After all, isn't the person who is *understanding* something *doing* something? Isn't *thinking* an acceptable kind of student performance? Aren't we interested in mental activity?

Of course. The problem is that intellectual behavior, in and of itself, is not directly observable. Its presence must therefore be verified by some other event that *is* observable. We must *specify* what sort of *overt behavior* we are willing to have stand for or represent the cognitive achievement we are seeking.

In the present instance, our Congress of Vienna objective might be modified to read: Given fifteen written statements concerning the peace settlement at the Congress of Vienna in 1815, the student will, in front of each statement, write the letter L if the statement relates to the concept of legitimacy, write the letter P if the statement relates to the concept of balance of power, write the letter B if the statement relates to both concepts, and write the letter N if the statement relates to neither concept.

We have said that, whenever it makes sense to do so, an adequate educational objective should set forth a *minimum standard* of acceptable student performance. Notice that our Congress of Vienna objective does not explicitly do this. That is to say, as it is now written, the objective makes no allowance for error. This is all right - *if* this, in fact, is the intent. However, if the teacher would be willing to settle for something less than errorless performance, this fact should be written into the objective. A single sentence could be added: The student will be expected to make not more than two mistakes in accomplishing this objective.

An adequate educational objective will describe the conditions under which the student is to achieve the objective.

Look at this statement of criterion performance: The student will be able to pronounce the names of the numerals, 1 through 20.

This objective is expressed in terms of observable behavior. Does it also specify the conditions under which the behavior is to take place?

It does not. First of all, our objective does not reveal whether the student is to pronounce the names of the numerals at sight or from memory. Further, if the numerals are to be shown, we cannot tell whether the student is to work with these numerals in regular sequence or in random order. The one set of conditions is obviously not the same as the other. Each will make its own demands upon the student who tries to achieve the objective.

We might, therefore, clarify our objective: Shown the numerals, 1 through 20 (in random order), the student, without error, will be able to pronounce the name of each numeral as it is shown.

Summarizing what we have said thus far, an adequate educational objective will specify under what *conditions* and (when appropriate) to what extent a certain kind of student *performance* may be expected to take place.

Educational objectives expressed in terms of observable behavior will enable students to take on an increasing measure of responsibility for their own learning. Three years of work with individualized instruction in the Duluth Public Schools have led to the creation of a six-point format for instruction that, hopefully, will promote this kind of student initiative. The assumption here is that clearly stated learning tasks will encourage the development of better learning strategies.

Our six-point approach for working with educational objectives may be described under the following headings:

CONTENT CLASSIFICATION
PURPOSE
CRITERION PERFORMANCE
SAMPLE TEST SITUATION
TAXONOMY CATEGORY
RESOURCES

Perhaps the best way to explain these headings is to construct an educational objective that can be used to illustrate what we mean. For this purpose we shall choose an objective that might well be included in teacher education programs throughout the land. The one we have in mind has to do with that maddening man of modern media, Marshall McLuhan.

Let us begin.

Our first heading, Content Classification, merely refers to the placement of our objective somewhere in the overall scheme of instruction. Ordinarily, this might mean fixing it within a course or subject matter outline. How and where this would be done would presumably depend upon the teacher who was planning to employ the objective. In the case of our Marshall McLuhan objective, a universe of possibilities would appear to be available. However, without worrying overmuch on this score, we might start by putting it under Philosophy of Education with the realization that further subdivisions would then be in order.

Our second heading, Purpose, is simply a brief explanation of why we think our McLuhan objective has merit: According to the February 21, 1967, issue of LOOK Magazine, "Marshall McLuhan is perhaps the most provocative and controversial thinker of this generation. His books, such as Understanding Media, have challenged many established notions about man and civilization. Now director of the Center for Culture and Technology at the University of Toronto, Professor McLuhan next fall will take the $100,000-a-year Albert Schweitzer Chair in the Humanities at Fordham University in New York." The purpose of this objective is to acquaint teacher candidates with the views of this man who says, "By the time this year's babies have become 1989's graduates (if college 'graduation' then exists) schooling as we now know it may be only a memory."

Our third heading, Criterion Performance, expresses in terms of observable behavior what it is that the teacher candidate will be able to do to show that he has mastered the objective: Given twenty statements, each purporting to reflect the thinking of Marshall McLuhan, the teacher candidate will be able with at least 90% accuracy to identify which statements do in fact represent McLuhan's views.

Our fourth heading, Sample Test Situation, sets forth a few test items of the kind that will be used to check out the teacher candidate on the achievement of the objective:

Which of the following statements represent the thinking of Marshall McLuhan?

1. The medium is the message.
2. Television is hot.
3. Print is cool.
4. The key word in the new Electric Age is involvement.

Our fifth heading, Taxonomy Category, classifies our objective into one of several categories appropriate to the cognitive domain. Here any one of a number of taxonomies might be considered. Especially popular has been Bloom's Taxonomy of Educational Objectives: Cognitive Domain.

Certainly, this work has much merit. Nevertheless, it should not be swallowed whole.

For example, this particular taxonomy uses six major classes: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. On page 147, under Analysis, we find: "Ability to detect logical fallacies in arguments." On page 189, under Evaluation, we find: "The ability to indicate logical fallacies in arguments."

Now unless one wishes to make a federal case out of the distinction between "detect" and "indicate" we must conclude, I think, that some fuzziness has crept into the scheme of things. And this is understandable. On the positive side, what this discovery does for us is to give us back the courage of our convictions. We no longer feel wholly dependent on the mother ship. We are ready to do a little independent cruising on our own.

In any event, our McLuhan objective should presumably be classified as either Knowledge or Comprehension. Assuming that the twenty statements we shall use in the test situation will involve more than simple recall or recognition (that is to say, more than mere memory work), we are left with the obvious choice of Comprehension. So let's choose the obvious.

Our sixth, and last, heading is Resources. What is wanted here is a listing of materials, procedures, persons, activities, etc., that could be used to help the teacher candidate attain the objective. For our McLuhan objective, we might include the following items:

A. Book: Understanding Media, by Marshall McLuhan

B. Article: "The Future of Education: The Class of 1989", by Marshall McLuhan and George B. Leonard in LOOK Magazine, February 21, 1967, page 23

C. Article: "The Message of Marshall McLuhan", by Edwin Diamond in NEWSWEEK Magazine, March 6, 1967, page 53

D. Film: "Child of the Future", (National Film Board of Canada)

E. Book: The Medium is the Massage, by Marshall McLuhan and Quentin Fiore

F. Article: "From Instruction to Discovery", by Marshall McLuhan in MEDIA & METHODS Magazine, October, 1966, page 8

G. Article: "What TV is Really Doing to Your Children", by Marshall McLuhan in FAMILY CIRCLE Magazine, March, 1967, page 33

H. Film: "The Medium is the Massage" (McGraw-Hill Book Company)

I. Article: "Marshall McLuhan Massages the Medium", by Marshall McLuhan in NATION'S SCHOOLS, June, 1967, page 36

J. Article: "A Schoolman's Guide to Marshall McLuhan", by John M. Culkin, SATURDAY REVIEW, March 18, 1967

Putting together the six-point format for our McLuhan objective, we would have the following:

SAMPLE TEACHER EDUCATION OBJECTIVE

Content Classification

Philosophy of Education

Purpose

According to the February 21, 1967, issue of LOOK Magazine, "Marshall McLuhan is perhaps the most provocative and controversial thinker of this generation. His books, such as Understanding Media, have challenged many established notions about man and civilization. Now director of the Center for Culture and Technology at the University of Toronto, Professor McLuhan next fall will take the $100,00-a-year Albert Schweitzer Chair in Humanities at Fordham University in New York." The purpose of this objective is to acquaint teacher candidates with the views of this man who says, "By the time this year's babies have become 1989's graduates (if college 'graduation' then exists), schooling as we now know it may be only a memory."

Criterion Performance

Given twenty statements, each purporting to reflect the thinking of Marshall McLuhan, the teacher candidate will be able with at least 90% accuracy to identify which statements do in fact represent McLuhan's views.

Test Situation

Which of the following statements represent the thinking of Marshall McLuhan?

1. The medium is the message.
2. Television is hot.
3. Print is cool.
4. The key word in the new Electric Age is involvement.

Taxonomy Category

Comprehension

Resources

A. Book: Understanding Media, by Marshall McLuhan
B. Article: "The Future of Education: The Class of 1989", by Marshall McLuhan and George B. Leonard in LOOK Magazine, Feb. 21, 1967, page 23.
C. Article: "The Message of Marshall McLuhan", by Edwin Diamond in NEWSWEEK Magazine, March 6, 1967, page 53
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There is, of course, nothing final about this suggested approach for working with educational objectives. The essential point is that any format can be useful insofar as it lets the student know (a) what is expected of him, (b) how he will be evaluated, and (c) what means may help him succeed.

If we want students to grow in the ability to organize their own learning, care must be taken to establish a learning environment that will promote this result. Educational objectives are never achieved in a vacuum. Means shape ends.

R.L. Bright's belief that individualized instruction will sweep the field within a decade poses some important questions: What is meant by individualized instruction? Is it synonymous with independent study? It is feasible? What are some implications for present-day educational institutions?

Everyone has his own notion as to what constitutes individualized instruction. In my view, it means an arrangement that makes it possible for each student to be engaged at all times in learning those things that are most beneficial to himself as an individual. It is probable that this state of affairs can never be fully realized. The best we can do is to approximate it.

Individualized instruction is not the same as independent study. Assuredly, independent study is, at appropriate times, a vital element of individualized instruction. Nevertheless, individualized instruction is the larger aim. Independent study simply contributes toward its attainment. Confusion on this point has apparently led some people to suggest that individualized instruction cannot be instituted at the kindergarten-primary levels.

The issue is not whether kindergarten children can be turned loose to direct their own schooling. The question is: To what extent can we provide a variety of learning activities that(a) will be highly motivating, (b) will have enough self-instructional features to ease the problem of classroom management, (c) can accommodate a wide range of individual differences, and (d) will encourage the accomplishment of worthy objectives?

Let's attempt to clarify further the relationship between individualized instruction and independent study. Among other things, it seems to me that formal schooling should be trying to develop human beings who will become competent, life-long learners. This is a formidable task. It must begin early - when the child first enters school - and continue throughout the years of formal instruction.

At the heart of the matter lies practice, learning by doing. This should proceed in stages, moving gradually from teacher-directed to self-directed learning. The antithesis of this approach is exemplified at high school commencement exercises where, at the close of twelve or thirteen years of over-supervision, we earnestly tell the graduates, "Remember, this is not an end but a beginning". Then we say, in effect, "From now on, it's either sink or swim. You're on your own. It's strictly up to you."

Following this send-off, forty per cent of the college-bound fail or drop out of that institution during their freshman year. As for the others, including the ones who can't or won't pursue some kind of further schooling - well, they struggle along as best they can. And a growing number of these wind up unemployed: a far cry indeed from the ideal of responsible, life-long, self-directed learning.

The trouble is not simply that students have failed to acquire the habits of independent study (although it is that also). More to the point is the fact that schools have not been organized to encourage students to function independently when, individual by individual, they become ready to do so. As for the proposition that such readiness itself can be taught - this has scarcely been explored in any significant way.

Individualized instruction, when it is serious and not merely sincere, can help students move toward the ideal of self-directed learning. For maximum effectiveness, this must be done on an individual basis. The reason for this is that what will be most suitable for one student at a given time will not necessarily be best for another. We have all heard over the years the silly argument that rages around the question of teaching kindergarten children to read. Much of the controversy might lead you to suppose that these youngsters had all been cut from the same mold. Fortunately, the issue quickly becomes ridiculous as we stop to look at a particular boy or girl and ask: Is this child ready to learn to read? (Or perhaps even better: What might we do to help this child become ready to read?)

It is one thing to talk a good game of individualized instruction. Educators have been doing this for years. It is something else to make the institutional changes necessary to move us within shooting distance of the target.

What are some of the things that need to be done?

We could make considerable progress by abolishing subject matter time schedules. Modular scheduling is a step forward in this respect, but (at least in its current phase) it is still basically a conservative movement that tends to substitute one set of restrictions for another. Although modular arrangements have succeeded in breaking through the unvarying 45- to 55-minute time slots that characterize most traditional secondary schools today, the typical "flexible schedule" often has its own rigidities that are only just beginning to yield to such devices as open laboratory periods of long duration. A more vigorous push for freedom is called for. From the third grade on, there is no sound reason why an individualized program cannot offer substantial opportunities for each student to budget his own time. Here again performance objectives are the key. For when these are clearly formulated, they make it administratively feasible within wide limits for every learner to schedule his own activities. Indeed, it would not be amiss to call this scheduling by objectives.

Performance objectives suggest another reformation in formal schooling. This one has to do with the traditional sanctity of subject matter boundaries. I can remember being a college student before it occurred to me that the things I was studying in various courses were somehow related. I do not believe my experience was unique. When subjects are taught in isolation, one from another, it is hardly surprising that students do not percieve the connections that exist among different fields. The steady growth of special terminologies within the disciplines only heightens the barriers to communication. The problem is a serious one and needs concentrated attention.

Some anxiety has been expressed in recent years over the increasing inability of scholars to talk with each other. This concern is not misplaced. Whatever near equivalencies do exist (and there are presumably many) need to be revealed for the benefit of all.

In the public schools, a renewed effort to see life whole has expressed itself in humanities courses introduced at the secondary level. The central purpose of the humanities (when it is seen as being something more than a survey of the fine arts) is to pose, and attempt to answer, man's most enduring question, "Who am I?"

Such an undertaking requires that subject matter lines be crossed with impunity. In fact, it may be desirable to think of the entire curriculum as consisting of two major divisions: a basic skills division and a humanities division.

Customarily, certain subjects have been taught single-mindedly as basic skills. Science, for example, has generally meant frogs and test tubes. Mathematics has been almost exclusively concerned with the manipulation of the language of numbers. All well and good, as far as this goes.

Nevertheless, both science and mathematics should occupy outposts of influence within the humanities. The compelling ways in which science as a method has re-stitched the fabric of our times must receive fundamental attention. And mathematics, insofar as automation is based upon it, must accept partial responsibility for the coming redefinition of work and leisure in our society.

In this view of the humanities, all subjects have their parts to play. And the time to begin is when the child first enters school. In Bruner's frequently quoted words, "It is possible to teach any subject to any child at any age in some form that is honest - and interesting. The challenge is to find how to represent the idea in a mode that is within the child's reach and then to proceed from there to a more precise and deeper representation."

Performance objectives also mean that we must eliminate the kind of formal schooling whose annual beginnings and endings move in time to the less-than-pervasive rhythms of an agricultural society. Courses of study that commence in September and finish in May or June violate a basic premise of individualized instruction: namely, that what animates effective education is the development of competencies rather than the serving of time. Although the citizens of our nation take vacations that are, increasingly, scattered throughout the year, our educational institutions continue to make Mother and Dad feel like criminals for taking Suzy out of school during February. Adherence to performance objectives would quickly do away with this archaic approach to instruction.

Finally, performance objectives will depend for their care and keeping upon a new product that has not yet come forth from college and university teacher education departments. This new product is the teacher for the decade ahead. Because teachers tend to teach in the way they have been taught, it is of crucial importance that institutions of higher learning - now, and without delay - begin a radical revamping of their teacher education programs. This is no time for peripheral considerations that involve sprucing up a course here and there, or altering an occasional requirement for graduation. What is wanted is a complete overhauling of the existing structure. As a starter, this might include (a) the placing of teacher candidates in a completely individualized program of education, (b) the use of performance objectives as the basic ingredient of teacher education, and (c) making it possible for teacher candidates to begin working with children at the beginning of the candidate's career preparation, not toward the close of it.

Other developments would also seem indicated, among them the abolishment of formal classes as such, and the creation of new kinds of learning spaces appropriate to the task at hand. In some instances, these latter things have already occurred. Indeed, some of the physical changes in buildings appear to have advanced substantially beyond what's happening inside.

In any case, the basic job remains to be done. The university professor in general, and the professor of teacher education in particular, is a difficult animal to reform. Whether the strong and growing interest in education throughout the country will eventually induce him to cooperate is a moot point. Only time will tell.

DESIGNING AN ORGANIC CURRICULUM

by Robert M. Morgan and David S. Bushnell

Introduction

In the early 50's American education experienced its first widespread public scrutiny. In reaction to the dramatic scientific achievements of the Soviet Union at that time, the American people wanted to know: "Why are we behind?" In our frustration and bewilderment at having been bested by our cold war antagonists, we turned critically to the principal shapers of our engineers, scientists, and mathematicians in our schools. This attention resulted in significant changes in the educational system. In the decade following "Sputnik", whole subject matter areas were revised. We now have new math, modern physics, and new reading programs. Programmed instruction, computer-assisted teaching, and instructional television are passing from the experimental to the operational phase. Among the more important consequences of this focused attention is the realization by the public that the schools can change.

For years the United States has led the world in its commitment to the goal of equal educational opportunity for all citizens. Universal education for virtually all American children between the ages of 6 and 13 has been achieved. At the high school level, the United States leads all other nations in the percentage of 17-year olds enrolled in full-time schooling. A recent UNESCO survey reported the United States with 81 per cent, England with 56 per cent, Belgium with 30 per cent and Germany with 13 per cent of this age group enrolled in full-time education. Almost 70 per cent of the youngsters in the United States who start in school at age 6 actually graduate with high school diplomas.

Our leadership at the college level is indicated by the fact that only 4 per cent of college-age youth in the European Common Market nations receive university degrees in contrast to 20 per cent of their American counterparts. These seem to be heartening figures, especially when viewed in light of today's employment statistics.

It is true that we are educating more of our young people than any other nation - but is that sufficient? Last year's class of college graduates represented only about 20 per cent of those who first began school. Nineteen per cent of this group left school before the eleventh grade; 30 per cent didn't finish high school. Thirty-five per cent entered college but only 20 per cent graduated with a Bachelor's degree. Thus, 8 out of 10 of these students were candidates for jobs requiring less than a college degree.

Yet only one of these 8 received any kind of occupational training in the public school! The remaining 70 per cent have historically had a limited number of options open to them. They can take entry-level jobs that have little skill requirements; but these jobs are becoming fewer. They can be employed and trained by private industry in on-the-job or vestibule training programs; however, rapid economic expansion and changes in technology have made it more difficult and expensive for industry to provide this kind of training. A relatively small number can engage in apprentice training, but again, there are a limited number of such programs available. Some will enter post high school vocational or technical training in community colleges or private institutes.

It seems clear that more Federal funds are needed to assist the established public educational institutions to develop and make available relevant educational and training programs which are responsive to the present economy.

A soaring technology and a healthy modern economy largely depend upon our ability to adapt to changes in productive capacity. Not only are engineers needed to design and install new and improved equipment, but more trained technologists are required to plan and manage production, to maintain automated apparatus, to sell and service the product, and to conduct research for newer and better products. A growing modern economy also requires more and more teachers, scientists, and professional managers, advertising and sales people, computer programmers and technicians, and mechanics and maintenance workers of all kinds.

Young jobseekers, faced with a continuing shift from production-oriented occupations to service occupations, require a broad base of cognitive, communicative, and social skills. Many of the former types of entry-level occupations are now unavailable to youngsters entering the labor market. Further, while qualifying for an entry-level occupation is a necessity, a person's first job can no longer be viewed as a final career commitment but should be looked upon as the first in a series of job changes leading, hopefully, to a stable and satisfying career.

Unfortunately, much of what is now taught in our public schools fails to recognize that technology is generating profound changes in the nature of work. The tendency in the past to separate general and vocational education has penalized both those who are college-bound and those who plan to terminate their formal education at the end of high school or junior college. The academically oriented students are directed to college preparatory programs which will enhance their chances for college admission. They have little opportunity to acquire a knowledge of the occupational world in which they will live and earn a living as adults. At the same time, vocational students receive too little opportunity to develop competence in the basic educational skills which they must have if they are to cope adequately with present day society.

Those who plan to go on to college are not prepared to cope with the question, "What happens if I leave college before graduation?" On the other hand, those exposed to current vocational programs frequently find themselves being trained for a narrow range of job skills. Even if such students should qualify for their first job, they are still faced with the need to adapt to a changing labor market. A third and large segment of our public school population is not enrolled in either vocational preparatory or college oriented programs. These "general" students often receive a diluted program which in too many cases provides little academic or occupational preparation that is useful to them in the adult world.

From the perspective of providing for the optimum development of all students, the present allocation of resources and the types of curriculum available in the secondary schools are inadequate.

Purpose

The problems and shortcomings associated with our present-day programs of education indicates a need for a major redefinition of goals and an overhaul of the educational process. Fortunately, the technology which created many of these problems offers some hope for their solution. The computer, for example, can serve as an intermediary between employers and school counselors, making possible far better information systems for funneling industry's job needs to curriculum planners in the schools.

Flexible scheduling through computers can make possible the development of learning experiences to meet the particular needs of individual students; and indications are that computer-mediated instructional techniques can succeed in permitting the student to involve himself at his own rate in the learning process. Even computer games have been successfully employed as a method of teaching teenagers to think through appropriate career choices.

The use of instructional television, single concept films, videotapes, teaching machines, and simulators should be commonplace resources in the classroom by 1975. Textbooks will appear which will gear the information to the background and reading level of the student. Experiments with tutorial programs employing older students and subprofessionals offer hope for giving more intensive attention to those children requiring it, while at the same time helping to offset the spiraling cost of education. Each of these examples illustrates that we are in the take-off stage and can, with appropriate planning and funding, achieve the outer reaches of educational excellence.

Under the stimulation of Federal legislation, new opportunities for research on major curriculum redesign are now possible. These opportunities are occuring at a time when teachers, curriculum planners, and school administrators are under pressure to provide today's youngsters with the kind of education which is relevant to living in today's world. It would be a mistake, however, to let employers with their frequently narrow entry-level skill requirements or even parents with their sometimes unrealistic career expectations dictate the type of education which should be available in our schools. The educator and the employer must work together to determine the appropriate knowledge, skills, and attitudes which will qualify today's students for their life roles as employed adults and citizens.

Unless we radically modify our present system, we will not succeed in designing an educational program which will be responsive to the present day needs of students. The desired program should permit the maximum self-actualization of each individual. If a youngster leaves school before graduation, he should leave with functional skills. The student who graduates from the program should possess the necessary qualifications for maximum flexibility in his post high school activities. He might enter a university or a community college and pursue an academic program. He might enter a community college or a technical school and receive post high school occupational training. He should also have the additional option of continuing his education in an adult education program, if he chooses. The key point is that he should be able to decide which option to choose after high school graduation, not three or four years before!

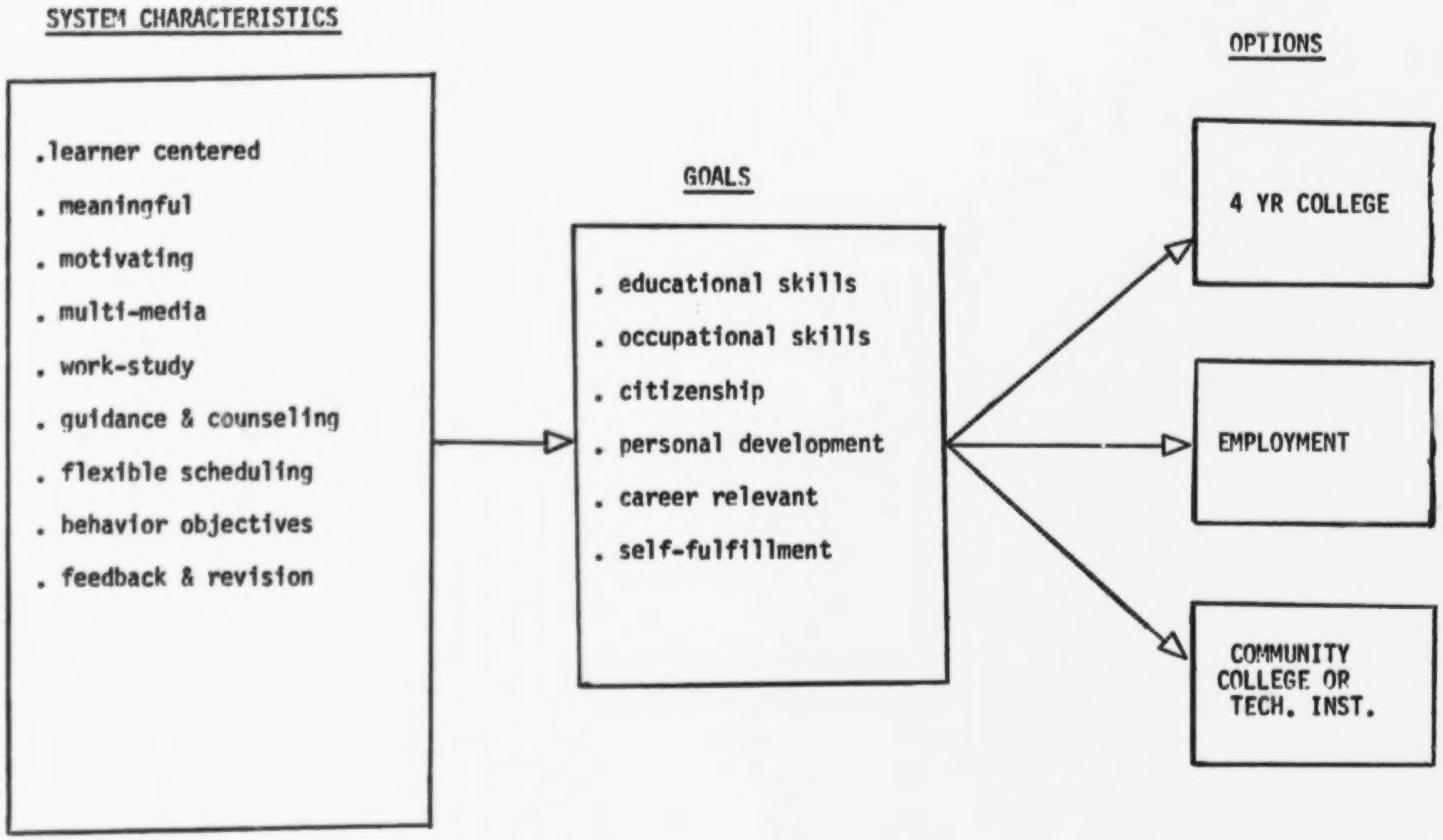
An Organic Curriculum

The first step in building such a student-centered curriculum is to study those behavioral attainments needed by the individual for entry into a variety of post high school activities. Whenever possible, these requirements should be stated specifically and in measurable behavioral terms. Following the lead of the systems analyst, we should describe specifically and precisely as possible the learning experience which would lead to the desired behavioral outcomes.

The ingredients of a high school program which will assure the attainment of these specifications will certainly include academic as well as occupational training but should also include such components as personal development, real work experience, and personal and vocational counseling (see Figure I). Even the avocational or school-sponsored

AN ORGANIC CURRICULUM

Figure No. 1


SYSTEM CHARACTERISTICS
.learner centered
. meaningful
. motivating
. multi-media
. work-study
. guidance & counseling
. flexible scheduling
. behavior objectives
. feedback & revision
GOALS
. educational skills
. occupational skills
. citizenship
. personal development
. career relevant
. self-fulfillment
OPTIONS
4 YR COLLEGE
EMPLOYMENT
COMMUNITY COLLEGE OR TECH. INST.

recreation or social programs may be considered an integral component in this system. Each of these components and sub-parts must be defined in terms of its contribution to the attainment of the specified behavioral objectives.

The most important feature of such a curriculum is that it is learner-oriented rather than process or subject-matter centered. The integration and interaction of the components will be a result of careful systems design. There will be no discrete demarcation between academic and occupational training or between these and other parts of the system. The truly integral curriculum must be developed so that each activity relates logically to all other activities and leads to the efficient attainment of the behavioral goals.

A massive research effort is required to develop and validate this system. Such an effort is presently feasible and can produce significant improvements in the learning process. An "organic" curriculum, as envisioned, would necessarily have to be interesting, challenging, and motivating to each student. It would probably utilize appropriate self-paced and self-instructional technology and maximally accommodate individual differences in learning rate. It should be designed so each student will succeed and yet it should be rigorous in level and content. Furthermore, after thorough experimentation and revision, the integral curriculum should be capable of implementation in or adaptable to many different comprehensive school systems in the nation; and it should be cost effective in the implementation stages.

In general, the overall design of this curriculum should:

(1) Integrate academic and vocational learning by appropriately employing vocational preparation as one of the principal vehicles for the inculcation of basic learning skills. In this way learning could be made more palatable to many students who otherwise have difficulty seeing the value of a general education.

(2) Expose the student to an understanding of the "real world" through a series of experiences which capitalize on the desire of youth to investigate for himself.

(3) Train the student in a core of generalizable skills related to a cluster of occupations rather than just those related to one specialized occupation.

(4) Orient students to the attitudes and habits which go with successful job performance and successful living.

(5) Provide a background for the prospective worker by helping him to understand how he fits within the economic and civic institutions of our country.

(6) Make students aware that learning is life-oriented and need not, indeed must not, stop with his exit from formal education.

(7) Help students cope with a changing world of work through developing career strategies which can lead to an adequate level of income and responsibility.

(8) Create within the student a sense of self-reliance and awareness which leads him to seek out appropriate careers with realistic aspiration levels.

There are many unanswered questions that must be researched before such a curriculum can become operational. The problem of logistics alone are large and complex. How do you control the flow of students through the program without inhibiting individualized learning? Without the traditional "Carnegie units", how can school accreditation be achieved? As the roles of teachers change, will the emerging roles be acceptable? Would this system work better in a 48-week time cycle than in a 36-week cycle? How can the guidance activity contribute more effectively toward accomplishing the system objectives? How can present instructional media be most effectively used and what will be the nature of required new media? What are the problems involved in cataloging and programming the specific behavioral objectives of an entire curriculum, especially one as ambitious as this? These and many other fundamental questions must be answered before we reach the "Kittyhawk" phase of what could become a moonshot for education.

Current Programs

While most of the research and development efforts in curriculum have been small and fragmented to date - directed to the improvement of a particular subject matter area - more recent pilot efforts to redesign an entire curriculum are in evidence. A number have been focused on the problem of keeping young people in the system long enough for them to benefit from the experience. The most important feature that characterizes these efforts is the integration of two educational areas that have been traditionally quite separate - the academic and the vocational.

In Richmond, California, for example, a major effort was made to integrate the vocational and general educational curricula. This was done by redesigning the content of traditionally-taught subjects so that they related as much as possible to job training programs. Math was taught by means of job-related examples and problems. Communication skills were related to performance requirements on-the-job. What were at one time judged to be potential dropouts in the tenth grade became, by their senior year in high school, candidates for technical training at nearby junior colleges.

Another effort in relating the verbal-skill-oriented high school's general education program to the interests of many students was carried out by an M.I.T. curriculum study group. Working with a group of dropouts, they successfully managed to capture and hold the interest of youngsters who rejected the normal pattern of schooling. It was necessary to develop a free interchange among the different academic subject matters, bringing together various pieces of learning into a cohesive whole, in which these areas are not fragmented but have an overall direction and purpose. By following this course of action, the possibility of early failure was minimized as youngsters moved from the relatively unstructured atmosphere of the elementary school into the more structured curriculum of the secondary school.

Job Corps centers have provided an excellent opportunity for designing learner-centered programs independent of many of the traditional constraints. In trying to define what the end product of such a program should be, the Job Corps educational planners determined that the economically self-sufficient, socially adaptive citizen needs many of the things offered by the traditional school system and much that is not. He not only needs basic educational skills but he needs to know about the workings of our society and his role in it; he needs to develop a realistic and favorable self-concept; he needs several career strategies to be able to operate effectively in our free enterprise system; and he needs the personal development that will permit him to make socially adaptive responses.

The Program Plan

These and other experiences point up the need for a coordinated research effort that can lead to the construction of an "organic" curriculum.

A research project for which there is pressing need is a parametric experimental analysis of the instructional process. The first step in this experiment would be the definition of the behavioral objectives for the content of selected courses and the instructional strategies would then be planned. These strategies involve the selection or design of modular instructional activities which would use whatever media or method or combination of these that appears to be most appropriate for the attainment of the objectives. The method/media mix for any given sequence of objectives might include programmed instruction, single comcept films, text readings, tutorial sessions, group discussions, computer-assisted instruction, slide-tape presentations, etc. The optimum mix of learning experiences would be developed by systematically varying the method/media permutations and testing for their teaching effectiveness. (Figure No. 2 is a functional flow chart of a systems-designed instructional model).

This validation of the learning experiences requires sensitive and sophisticated instruments for frequent measurement of behavioral objective attainment. Implicit in this system is that the student only learns what he doesn't already know and that he will move as rapidly as his ability and motivation permit.

The behavioral objectives and information about what method/media combinations are most appropriate for teaching students of varying abilities and interests are then stored in a computer. When the student enrolls in the course, he is measured in terms of his entry performance on a representative sample of the behavioral objectives and this information is fed into the computer. The computer then looks at the characteristics of the student and how much he already knows and prescribes an empirically validated learning package for him. When this package is complete, the learner will be retested and the next learning package will be prescribed.

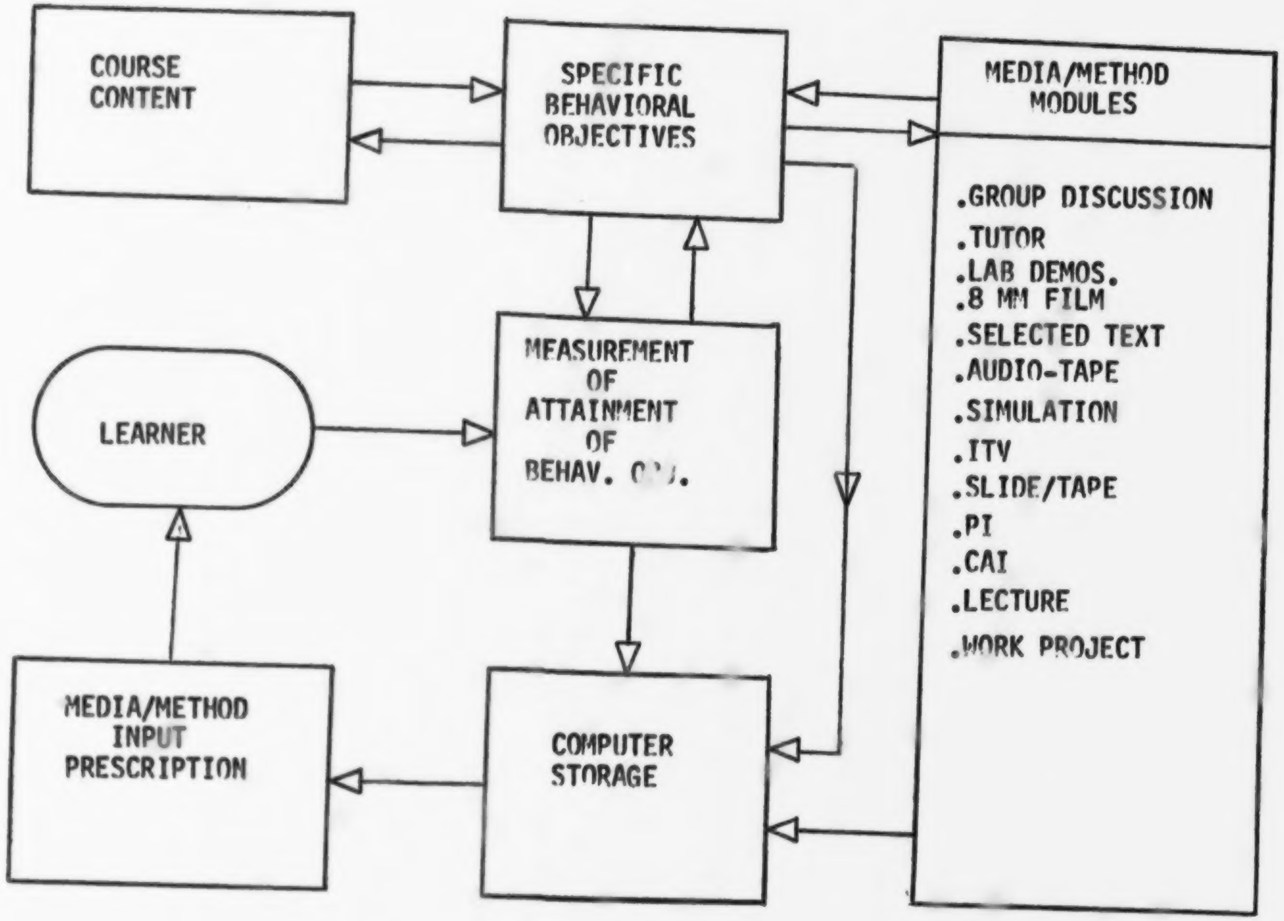
This will be "programmed instruction" in the broadest and most desirable sense. The student will have almost immediate knowledge of results, will work at his own rate and will have a high proportion of success experience in the learning situation. It is likely that much of the material in this system will be self-instructional.

While this experiment involves only single courses, the model should prove equally effective with an entire curriculum. The utility of such an instructional system in the curriculum that has been described should be clear. Indeed, the curriculum visualized probably could not work without such a flexible and individualized instructional program.

A study that systematically analyzes the effect on learning of all the major variables should have great value for educational planners but it is only a first step in building an optimum curriculum. Shown in Figure 3 is a functional flow chart identifying some of the more obvious activities that must be undertaken. Behavioral objectives must be defined and classified so that they are acceptable and useful to the pilot schools. Indeed the teaching staff and curriculum planners and administrators of these schools should become intimately involved in the effort at its inception. Much research and validation of program elements must be completed before a new system can be installed in a school for practical testing. The criteria for measuring the success of a systems-

Model for a Single Course Instructional System

Figure No. 2

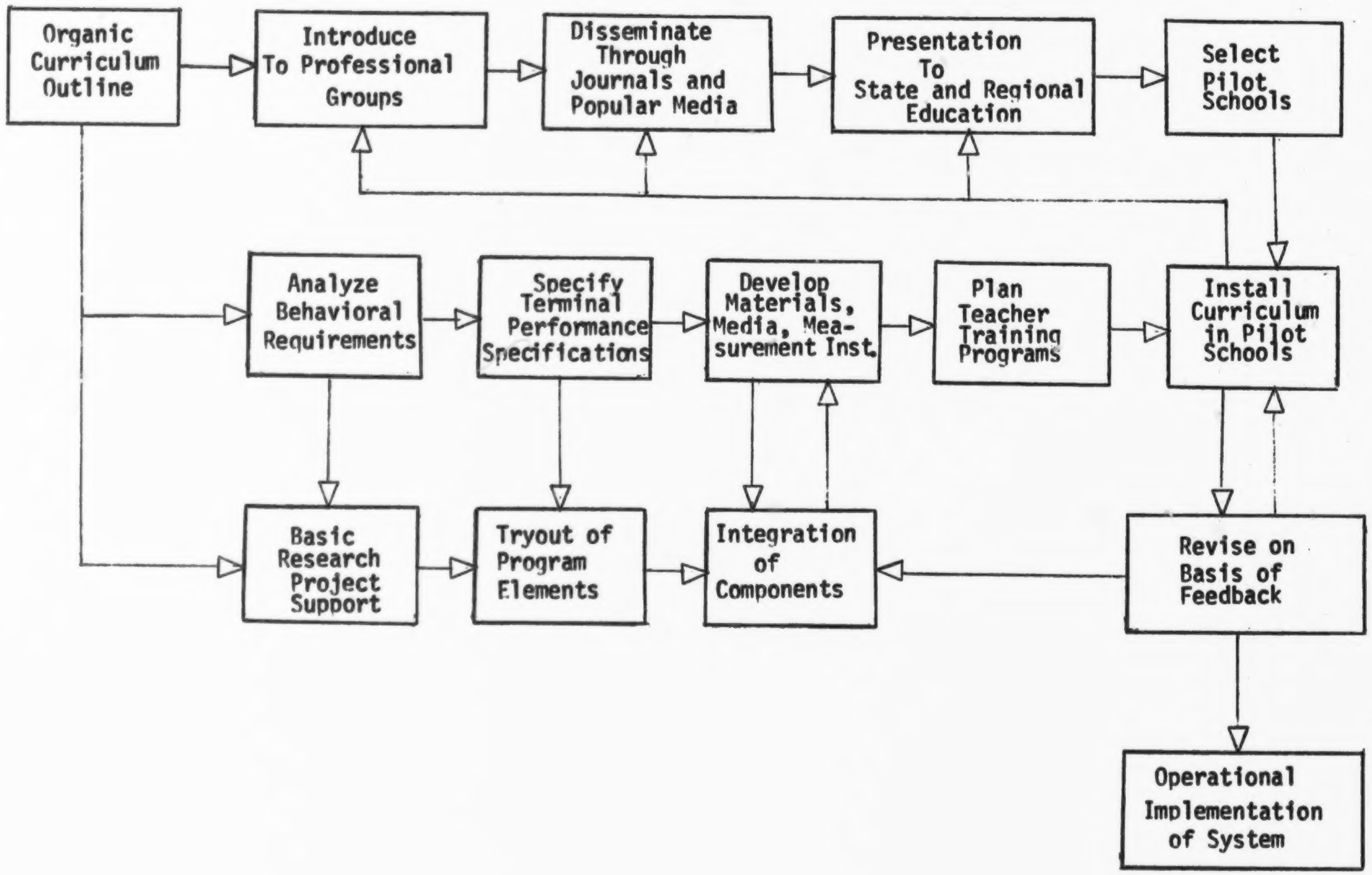

COURSE CONTENT
SPECIFIC BEHAVIORAL OBJECTIVES
MEDIA/METHOD MODULES
.GROUP DISCUSSION
.TUTOR
.LAB DEMOS.
.8 MM FILM
.SELECTED TEXT
.AUDIO-TAPE
.SIMULATION
.ITV
.SLIDE/TAPE
.PI
.CAI
.LECTURE
.WORK PROJECT
LEARNER
MEASUREMENT OF ATTAINMENT OF BEHAV. OBJ.
MEDIA/METHOD INPUT PRESCRIPTION
COMPUTER STORAGE

designed curriculum must include longitudinal data on the post-high school performance of the students.

As important as attempting to build a demonstrably superior educational program is taking all the measures necessary to insure its acceptance by professional educators and parents. An exotic program that is not feasible for adoption in other schools will be of little value. It is encouraging to note that the resources essential to such an undertaking are available and that there are schools willing to participate in these innovational activities. The concept of a truly integral and excellent educational experience can become reality for the nation's young people.

Plan for Implementation

Figure No. 3


Organic Curriculum Outline
Introduce To Professional Groups
Disseminate Through Journals and Popular Media
Presentation To State and Regional Education
Select Pilot Schools
Analyze Behavioral Requirements
Specify Terminal Performance Specifications
Develop Materials, Media, Measurement Inst.
Plan Teacher Training Programs
Install Curriculum in Pilot Schools
Basic Research Project Support
Tryout of Program Elements
Integration of Components
Revise on Basis of Feedback
Operational Implementation of System

POLICY CONSIDERATIONS FOR CONTINUING EDUCATION DURING THE NEXT DECADE

Leo Molinaro

Experimentation, research and development are core components in our rapdily changing economy. The federal Government has focused upon these energies in establishing national goals on mutual defense systems, the development of national ventures in outer space and oceanography, health and educational programs, transportation and a number of other aspects of human life in the nation. This is not new to the federal government. It first embraced the method of science in its land development programs when the concept of land-grant colleges was made national policy more than a hundred years ago. At the local level, quite the contrary, the community college movement which is gathering momentum contains no comparable commitment to experimentation, research and development in community affairs. We have left this vast frontier to a handful of universities, private institutes and foundations which are historically and organizationally inadequate to the task.

Given the history of our public and private educational systems, it is no surprise that education beyond traditional schooling has developed without plan or purpose, opportunistically responding to every new movement from "uplift" fads such as the "Great Books" and "personality development" to tempting propositions for "earning money in your spare time." At the same time, many programs have been well-conceived and conducted to the benefit of those who participated in them. Almost without exception these have been programs related to career development, skills maintenance, or the transfer of skills to new vocations. Almost without exception these programs have been inspired, conceived, conducted, and/or funded by industrial organizations (or industry-related groups) and government -- especially federal government.

However valuable these programs have been, they have developed without the benefit of conscious, systematic planning and policy. It may well be aruged that this lack of definition of purpose and plan has really had a positive effect in producting a wide variety of alternatives and avoiding premature formation of a "system." Even if we grant this, the time has clearly come for more systematic thought and action to establish local and national goals in continuing education and to build experimentation, research and development into local and national policy for continuing education.

The federal government has already initiated action in this direction. The Higher Education Act of May 1965 authorized the creation of the National Advisory Council on Extension and Continuing Education "to advise the Commissioner of Education on Title I program administration and coordination and the President and Secretary in the administration and effectiveness of all federally-supported extension and continuing education activities and services." The Council consists of two members with municipal government interests, one with an interest in civil rights, two with an interest in rural affairs, another representing the interests of business and professional women, three members drawn from institutions of higher education where they are administrators in continuing education or extension, one professor of education who specialized in adult education, and two university presidents.

This Council has completed a year's work resulting in a report with specific proposals for further action. It is quite clear that the Commissioner of Education intends framing policy and planning programs in continuing education and extension. This is all to the good. In fact, it is long overdue. The question that haunts some of us in the field is what are local and state governments doing to participate in these efforts to establish national policy and programs? There now exists a vacuum of local policy and planning into which will flow federal policy and plans. When this happens, local institutions, governments and groups will rush to seek funds. Many of these groups are quite incapable of carrying out effective programs. More than likely, the colleges and universities and public school systems will be made the major recipients of funds and monitors of local programs. It will not be long before we begin to hear the anguished cries of local leaders pleading for "local initiative" and"local prerogatives." This certainly will occur if federal grants are made for local programs in civil rights education or other equally controversial subject matter.

Another likely consequence of the federal government's lead in policy-making and planning is the inevitable flow of superior talent into federal programming and operations. In several technical fields of federally funded research and development, universities, hospitals and non-defense oriented industries have faced a critical shortage of scientists and engineers. More than one critic has blamed this on the creation by federal contracts of a vast "scientific establishment"that conceives, conducts and funds the activities of most scientists and engineers in the nation. Whether these critics are right or wrong is not to be argued here. What is important is that whomever is first with a clearly conceived policy and program in continuing education will attract superior talent. To avoid any "brain drain" to Washington, it is urgent that local institutions, local groups and local governments be made full partners in establishing policy and devising programs.

To accomplish this there must be a clarification of the roles of universities, colleges, institutes, foundations and other groups with vested interests in continuing education. Especially important will be the role of universities and colleges. At present the universities seem to have ambivalent attitudes towards continuing education. A confusing variety of degree and non-degree categories involve subtle nuances in status, funding, instructional quality and subject matter. Practically no hard research is underway and no funds are in sight to pay for such research.

The traditional "Ivory Tower" aloofness is still very much alive although it now operates with such up-to-date disguises as delicate distinctions between "problem-solving" and "pure research". Few university leaders seem to have the stomach for establishing daily working relationships with City Hall or even the local Board of Education. In the large urban areas where both city and university share the impact of urban decay and urban tensions, there is real evidence of progress and hope for significant new relationships.

Industry also receives arm's length treatment from higher education. While this situation is being changed in some of our larger cities and great universities, the overwhelming majority in the academic community still finds it very hard to accord "equal time" to the concerns of business and industry in educational policy and planning. As a result, industry has had to construct a very substantial continuing education establishment of its own outside the university. This may or may not be a good thing. The point here is simply that the university must clarify its role over the next decade vis a vis the local community and industry.

More specifically, the local community and industry will require more assistance in setting up information systems for their particular needs. They will need highly trained personnel who can count on continuing education for skills maintenance. They will need university researchers who will develop new informational systems and teach them to governmental and industrial staff people. Specific problems will arise requiring research followed by instruction in the results of the research. In sum, the political and economic institutions of the local community will confront higher education with increasing frequency requesting assistance in finding answers to problems and then teaching these answers to employees and the citizenry. The universities will find it increasingly difficult to "look the other way" because they will depend more and more upon tax dollars and industrially-derived contributions to operate. The most important organizational issue in continuing education will be shaped by these demands for service and the historical reticence of the institutions of higher education to participate in community life.

On the other side of the issue, industry and local government will have to find new ways of identifying their problems so that universities can respond to them. Industry and local government cannot simply "dump" unresolved questions on universities and await answers or solutions. Obviously, reformulation of problems is in order. "Operations research", "systems analysis" can move us ahead in this task but they are inadequately understood by most policy makers and executives.

The most significant area in which continuing education bridges community and industrial concerns is in human resources development or, more directly, in upgrading the skills of the local manpower supply. Upon this upgrading depends the survival or many civic and business ventures. The new generation of brain-based industry with all the desirable side effects for the community simply cannot be cultivated by a community without extensive opportunities for continuing education for professional and technical personnel. Without these new industries, the local community cannot improve its tax base from which, in turn, flows the resources for public enterprises which support and improve the human condition.

The cut-throat competition among cities and among large urban regions to attract and develop the new generation of brain-based enterprises cannot continue unchecked for another ten years without serious impact upon the economies of these competitors and, ultimately, the entire nation. Continuing education opportunities and facilities will have to be distributed much more rationally throughout the nation in order to help equalize the quality of manpower and therefore stabilize economic growth and activity.

Related to these developments are the magnitude and variety of clients and students for continuing education generated in the polity and economy of a nation in the midst of a scientific revolution, a population explosion and a human rights revolution. In the developing urban areas of the nation are vast, intricate systems of information on tasks, operations, and skills which must be reorganized continuously for transmission to those who operate these systems.

The managers of our public and private enterprises, the policy planners and engineers, the scientific investigators, and the rank and file citizenry must from time to time comprehend enough of these enterprises to pass judgment in public hearings and elections. These personnel are organized into manpower systems, production systems, consumption systems, distribution systems, shelter systems, recreation systems, education systems and transportation systems. Continuing education will operate in every one of these systems to provide career development through skills maintenance and skills transfer from the highest executive to the beginning unskilled worker, from the top level policy makers to the rank and file Civil Service worker in government agencies.

In terms of raw demand, continuing education facilities will be as overwhelmed in the '70's as the public schools were in the '50's and the colleges are currently. It is quite obvious that little or nothing is being done to establish policy at the local level to cope with this demand. Even at the federal level, the needed effort has just barely been initiated. The next three years will be vital for planning. After that, sheer demand will not leave time or people to do much planning.

The urbanization of employment, especially in the professions and technical vocations, will require innovation in continuing education beyond anything yet imagined. The very nature of knowing has changed; the nature of learning is changing; the nature of teaching must change. Knowledge will not continue to be organized in traditional disciplines that have served the academic community for so many years. It is clear that the integration of knowledge is occurring as it is translated into information systems. Those who seek knowledge in the form of information for specific applications are more apt to organize such information in terms of issues, missions or tasks, problem-formulation, accessibility, and per-unit-cost in man hours or equipment costs. The format or package for organizing information is less likely to be a classroom lecture at a given place and time to a limited number of students; it is less likely to be based upon a number of hard-back books stored in a library. Instead, the format or package of information is more likely to vary with every individual and every occasion and even to vary for each individual depending upon where he is, how much time he has, and what he must do with the information.

The hallmarks of continuing education as it responds to the urbanization of employment will probably be: individual study, self-testing, and on-the-job education. The technology for individual study and self-testing has come a long way and awaits only a more fully defined market to become as available as a phonograph or slide projector. The major obstacle is the program content. When excellence of program content is established by qualified university and industry experts, the demand for the technology will make volume production feasible with a reasonable pricing structure. Individually-programmed, computer-assisted instruction will become feasible.

In addition to the tremendous impact of the urbanization of employment on continuing education will be the demand for off-the-job, non-career related continuing education. Retired workers, vacationers and those who cannot or do not need to work will double the number demanding opportunities for continuing education in the 1970's. There is every indication that more "fringe benefits" will include opportunities for continuing education in the form of cultural activities in the performing and fine arts. It is not inconceivable that governments at local and federal levels will be called upon to provide continuing education for those adults who have not participated in the mainstream of our national or local cultures. It has been argued, for example, that a serious aspect of the rural disadvantaged is their isolation from the developing urban culture of the nation. In fact, the eyes of many for their contribution to development of the individual's capacity to participate in the culture of the nation.

The content, instructional media and methods of such continuing education have not received much serious systematic attention. People smile at "Sunday painters." With millions of people seeking instruction in the arts, whatever their motives or capacities, it will become a serious educational problem to devise content and provide materials and personnel which do not vulgarize through popularization. Every professional art school and serious artist in the nation will be needed to help establish and maintain standards while providing the desired participation in the arts.

Still another significant source of demand for continuing education in the 1970's emerges from the dilemma of highly urbanized governmental policy-making. As more public programs are formulated by specialists and technical experts, the distance between the citizen and the decisions that govern him lengthens. We have a portent of the future in the alienation of our youth. It is quite possible that the rank and file citizen is beginning to feel alienation from the mechanisms of government. Certainly among Negores this alienation has been growing at an alarming rate. As our urban systems become more complex and urban management is comprehended by proportionately fewer and fewer persons, the need grows greater for education that promotes and permits effective citizen participation in public policy making and evaluation. Again, the universities have a unique opportunity to assume leadership since they are the only powerful institutions in the community which are neither a wholly political nor wholly economic creature but can stand someplace between these two forces. This role for continuing education may well prove to be its most urgent role. It is almost impossible to estimate the numbers of participants but it certainly could approach universal continuing education if the urgency of need were ever translated into programs which captured the imagination of the public.

Finally, a few comments are in order concerning research and development in continuing education. Up to this point in the history of education in America, there has been heavy emphasis upon the ideological mission of education. Various American philosophers of education have equated education and morality with the result that disputes over educational content have dominated the scene. Methodological discussions have been dismissed as being unworthy of policy-makers and philosophers. Nevertheless methodology has developed, more often than not without benefit of adequate testing and reformulation. Moreover, such methodology as has developed has done so without the talents of our best scientific investigators in education who find greater academic returns in the more accepted disciplines of psychology, sociology, etc. While these disciplines have made excellent contributions to educational learning theory and on occasion, even changed educational practices, educational methodology has never enjoyed the full acceptance of the scientist and engineer.

It is a cliche to point out the lag between new scientific insights and educational practices. Nevertheless, the gap remains and perhaps is even widening. If self-teaching, self-testing and individual study are really to become part of continuing education for career development, a great deal more research and development are required on communications technology, format of information, economics of such a system, and the impact on all other aspects of the individual's life. Estimates of the numbers of adults who will be seeking educational opportunities in the 1970's vay, but all are large enough to make it perfectly clear that there will be a drastic shortage of personnel, facilities and other resources. Yet no research missions have been commissioned to come up with answers on what will be needed, let alone how these needs will be met.

EDUCATIONAL MEDIA IN THE NEXT DECADE - A SYSTEMATIC EDUCATIONAL ANALYSIS

by Patrick Meredith

Synopsis

This paper aims to assess educational needs and possibilities in the next ten years rather than to predict or to estimate probabilities since the situation is full of indeterminate contingencies. In order to thread a systematic course of argument through a multiplicity of physical, biological and social considerations, all relevant to educational possibilities, the beginning of each section starts from the end-concept of the previous section. The whole argument is founded on a system of educational logic based on an analysis of the functional structure of educational behaviour in space and time, but too mathematical to summarize here.

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Introduction

A scientist speculating about the future tends to be apologetic, as if the very thought of the future were a methodological obscenity. To avert an accusation of unprofessional conduct he commonly prefaces his crystal-gazing by a subjective disclaimer such as "Of course these are only my personal views", thus treating the prophetic occasion as a moment of off-duty recreation, not to be taken seriously. His uneasiness is justifiable. His disingenuousness is not. For it implies that science has no concern with the future and is no business of persons. And neither of these propositions is true.

In other moods the scientist will quite happily offer all kinds of predictions - astronomical, seismological, epidemiological, economic, demographic and so forth. Indeed most of these who control the purse-strings of scientific research quite obviously regard prediction as the essential commodity which they are buying - just as in earlier times monarchs bought astrology. And it was Ostwald, a very eminent scientist, who declared that "Die Wissenschaft ist geradezu die Kurst des Propheiens". Personally I would agree that science is an art but *not*, repeat *not*, the art of prophecy. It is necessary to assert this *quite* emphatically because it is fundamental to what I have to say about the next ten years of education.

My standpoint is that science is concerned with the future not in order to predict what *will* happen but to demonstrate what *can* happen. For what has happened in the past on this planet of ours has quite demonstrably and increasingly been a partial consequence of man's decisions, and the essential characteristic of decision-making is its unpredictability. In what may happen in the next decade we all of us have some say, including the rulers and revolutionaries, and it is quite possible that there may not even *be* a next decade. Given this major uncertainty, and our awareness of it, any assertion of what *will* happen is semantically self-contradictory. It becomes all the more interesting, therefore, to explore what *can* happen and for this exploration we need all that science can offer.

Education is not only a process of communication - it is also a process of care and control - but if it is faulty in its communication everything else fails too. This justifies us in giving priority to the communication problem, even though its solution would not automatically solve all other problems. To-day we tend to speak of the "Mass Media" of communication as if they were something new. But from the very beginning of life organisms have propagated information massively i.e. they have encoded their changes of state as modulations of energy and radiated this structured energy outward to the surrounding mass of the environment. There, any other organism attuned to resonate to particular pulse-patterns in the spectrum of the signal can receive it and, if need be, respond to it. What is novel in this process is not its massiveness i.e. the one-many logical relation by which we can mathematically map it, but, on the contrary, its increasing individuation, i.e. the one-one relation which it has made possible. If we suppose a galactic observer with cosmic resources of instrumentation busy monitoring terrestrial emanations over several million years and mapping out a cummulative pulse-spectrum of signals (rather as the astrophysicist builds up his store of stellar information) we should expect him to note that over the last few thousand years an explosive escalation has occurred in the number of *unique* pulse-patterns. The earlier biological messages, genetically encoded, were massively repetitive except for the spasmodic diversification due to mutations. This relatively gradual diversification has never stopped but, superimposed on it, we now find an enormously more rapid diversification of messages of unprecedented structure originating in individual experience and transmitted to other individuals as such. If it were not for this fact mass communication would be no more of a "problem" than a volcanic eruption or the explosion of a super nova. It would be an interesting problem for science to explain but it would not be a problem in the sense that we should feel a compulsion to do something about it.

I suggest that our inescapable concern with the media of communication *as a problem* arises not only from our individual need to communicate, whether by gossip, writing, teaching or other modes, but even more compulsively because as parents and possibly grandparents we have an anquished commitment to the future, and especially because it is unpredictable.

Is this a commitment towards an imposed biological conformity of type? Are we really anxiety-ridden because our children sometimes insist on being different from others? If so we are trying to seem contrary to the whole tide of diversification. And when we see what happens to children who don't want to be different, such as the Hitler Youth, we should be mortally afriad of mass-conformity. At some relatively recent epoch in the evolution of society a swing-over has occurred in the relative dangerousness of conformity and non-conformity. In primitive societies conformity is essential for cohesion. In advanced societies it becomes a standing invitation to the demagogue and a mortal threat to human survival. The paradoxical implication for the planning of mass media is that our only safe course is to develop them as channels for the greatest diversity of individual relationships.

Now lest this be taken as a prescription for total anarchy we must consider the other side of the picture. And this is where we explore what science has to offer, and try to counteract the apocalyptic visions of doom which seem to have seized the imagination of so many writers of science fiction.

Although I am calling this a "systematic educational analysis" I shall not be expounding an analytical system, but rather using the concepts of the system to explore the educational possibilities inherent in the technical systems now being developed for the conservation, transformation and presentation of educational information. The system itself is essentially a three-dimensional geometry of *time* i.e. the patterns of timing of educational behaviour. It requires a three-dimensional display to present it and here I can only hint at its implications. It arose originally from a study of the design of educational films but more recently it attained logical precision and semantic clarification in research on the detailed operations involved in learning to read and write.

In exploring these patterns of micro-educational behaviour one becomes aware of the child's individual operations as forming a temporal system of interlocking cycles in which his own biological tempo is intermittently engaging with cycles determined by the physical properties of materials, implements and energies and also with longer cycles determined by the socio-linguistic properties of cultural, administrative, and pedagogic demands. Thus the small world of his learning has all the dimenions of the larger world of social living. It is the bearing of educational technology on his engagement with this larger world, with its mass media and inter-personal complexity, that I wish to explore in this paper.

§ 1. Possibility of Time

We have a very elaborate logic of probabilities resting, it seems to me on very dubious assumptions. If the concept of possibility is to be used both systematically and pragmatically in the analysis of education it needs a better foundation. If an event is known to have happened it is trivial to say that therefore it was possible but it is not trivial to say that it could happen again. If by "it" we mean the identical event it is plainly false. But if we mean "a similar event" this is an assertion whose verifiability depends on our having criteria of "similarity". In other words the event had a structure, the structure is known and we know of no laws which make it impossible that similar components could associate in a similar way in future. "Possibility" thus has a positive aspect in relation to the past and a negative aspect in relation to the future (viz. non-impossibility).

§ 2. Time and Control

Since educational planning has to be anticipatory over a long stretch of time, and a wide range of cultural achievements and demands, its strategy of anticipation is of extreme importance. A probabilistic strategy is inherently a gamble and as the stakes mount rapidly the cost of miscalculation can reach disastrous proportions. It is my wish to discredit the very foundations of such a strategy. For it requires ruthlessly dictatorial administration for its implementation and, paradoxically, the price of its success may be even higher than the price of failure. I mention the economic aspect first but the educational and human consequences of policies which are based upon what are essentially arbitrary predictions are no less serious. Since administration, however, means control, can we find an alternative foundation for control?

§ 3. Control and Instrumentation

Although the traditional Socratic technique of teaching was based on a concept of purely verbal dialectic even this required people with vocal organs and somewhere to sit and talk. All education makes material demands for manpower, instruments and architecture. These are the three great spending components of our educational economy. However spiritual or intellectual we may conceive the purposes of education they require carnal, corporeal carriers which cost cash, and this, in turn, requires considered control. It is the consideration on which the control-strategy is based which provide the insistent challenge to our educational philosophy- otherwise it is all pipe-dreaming. If we consider the mass media as part of the equipment of education the scale of this technology indicates the magnitude of the problem which any logic of educational planning must handle. It cannot handle it without instrumentation.

§ 4. Instruments and Materials

In the daily pressure of events to which administrators are exposed there tends to be an obsession with the rate of spending since this sets the pace of accountable decision-making. What is commonly overlooked is the basic material fact of conservation. Saving is a concomitant of spending and saving is a process of accumulating materials. Over twenty-five years ago when I was indulging in a prediction of the forthcoming "industrial revolution in education" (see "Regional Centres for Mechanical Aids", by P.M. in *Sight and Sound* 1940), I anticipated that unless the curricular and man-power problems of the new educational machinery were effectively tackled from the beginning we should, in a few years, find projectors rusting on their shelves. Much money has been spent since then but we are no nearer a logical strategy for dealing with the problems of man-power, materials and meanings.

§ 5. Materials and States

The sensible control of educational expenditure depends not only on the scrutiny of proposals for spending but also on an analysis of what is being done with the things on which money has already been spent. In other words we need a factual analysis of actual educational processes. And since this is needed in order to provide a foundation for rational educational planning and spending the analysis needs to be systematic. Moreover since it is essentially a question of value for money the analysis of the processes must be designed to show an objective measure of the educational yield. For this is the essential value which our money is buying. But there is no simple linear relation between the two. Not only is our whole concept of educational measurement involved here but also our concept of the developing *states* of our children as a result of both of planned and of unplanned spending, in and out of school.

§ 6. States and Phases

Our present system of educational measurements, whether by conventional examinations or by psychometric methods, is totally inadequate if regarded as an attempt to assess the effective state of a child. Yet that state is the essential expression of the educational yield from our policies of planning and spending. In every generation but most acutely in our own we find parents, teachers, administrators and legislators bewildered, dismayed and alarmed at the adolescent state of mind, after grinding years of teaching and examining. The elders of the tribe, who tend to have most control and responsibility, lay the blame on the children and their feckless parents. Can we afford any longer to ignore the requirement for all industrial processes to be submitted to continuous *quality control*? For education is our most massive industry, its product being a vast output of multi-phasic mental states.

§ 7. Phases and Cycles

If educational philosophy is to come to terms with educational economics without foregoing the essential *existential* values which define the *ends* of education it must gird *up its logical* loins for a resolute *analysis* of this extraordinarily complex psycho-physical relation (which I call the "YA" relation" in my analytical system) between *educational yield* (Y) and associative means (A). In much simpler dimensions the 19th century tackled this relation in its power economy, the relation between the desired output and the material input of a heat-engine. The science of thermodynamics was an expression of the economic demand for improved efficiency in the consumption of the coal. The logic of this science was established early in the century by Sadi Carnot who established the structure of the working cycle. This was essentially a temporal structure of energy-machine *phases*.

§ 8. Cycles and Signals

Among the most exciting advances in biological science is the discovery and analysis of the organism as a system of *clocks*. We have had a spatial anatomy of organisms for many centuries. We are now beginning to discern the possibility of a *temporal anatomy* i.e. a detailed description of the system of *interlocking cycles on which* the processes of living and learning intimately depend. We begin to conceive time no longer as an amorphous flow of mechanically increasing entropy but as an endlessly variegated symphony of individual and orchestrated rhythms. And this temporal anatomy of the individual child his parents, his teachers, the administrators, the legislators, the social system and the mass media are day by day, week by week, year by year, pouring a stream of signals which even if rhythmic in themselves, produce a chaotic noise when taken collectively. Can we devise an educational spectroscopy for disentangling the signals from the noise?

§ 9. Signals and Stimuli

In one sense our curricular planning of time-tables represents a kind of attempt to impose a meaningful rhythm of learning on what would otherwise be a random exposure to random events. And whilst criticizing its limitations we should recognize its merit in implicitly accepting the need for time to be structured. Where it fails is in using only the clock and the calendar in designing the structure. So poor and confused is our understanding of the anatomy of time that the administrator shrinks back in horror from the imagined chaos which would, he thinks, result from any attempt to base the time-table on individual biological clocks rather than the highly synthetic metric of Mean Solar Time propagated by mechanical clocks. What he ignores is the need for an organic relationship between the rhythm of curricular stimuli and the ebb and flow of sensitivity of the child.

§ 10. Stimuli and Responses

Even the mass media, chaotic as they appear in total presentation as we twiddle the knobs or turn over the pages, are inevitably rhythmic in their production, for they result from the working rhythms of human producers. The missing factor in this complex relation between the collective clock-system of stimuli and the individual clock-system of responses (missing in the sense of being overlooked rather than actually absent) is the selectivity of the individual. It is not altogether a caricature of our educational system to represent its attitude to the child as saying "You will learn what we want you to learn, when we want you to learn it and at the rate at which we can deliver it". The child, as an organism, replies, in effect "What the hell! I shall learn what I like and when I can".

§ 11. Responses and Resources

Only occasionally does a child verbalize this felt discrepancy between the topics and tempo of the curriculum and the topics and tempo of his own choice but the discrepancy is inherent in the many-one relation by which a multi-personal system, working by clock and calendar for multi-personal ends, imposes its demands upon the individual. Not that these demands, formulated through many centuries of educational thought, are in themselves contrary to the individual's interest. It is simply that their pattern and tempo of application are so little coincident with the ever-changing state of the individual. In themselves they represent the cultural resources of civilization. They embody all the creative moments of the past. But in the mode and moment of delivery their creativity all too often fails to spark off a creative response. The wealth is in the wrong currency.

§ 12. Resources and Wealth

It is not that the child has no sense of values. No organism can survive without a scale of values. The essential biological function of the changing mental state is a continuous evaluation of the global stream of both external and internal information forever puring into the brain through all the exteroceptive, interoceptive and proprioceptive nerve-paths. But the essential cultural function of that component which we call "the curriculum" in this global intake is not to transmit dead information about the past. Only in so far as it represents real wealth to the child in the present has it any educational significance. Thus the function is not information but *participation*. Our systematic analysis must therefore examine the *culture behind* the curriculum as an *activity*.

§ 13. Wealth and Culture

Money is not wealth unless it circulates. And culture is not wealth unless it activates. To activate a child you have to enter into his taste and his tempo. This does not mean that the child can dictate his own curriculum. By definition the child-to-be-educated does not know what civilization can offer him. But every moment of history in which an element of culture was generated *was* a creative moment in the taste and tempo of its participants and this is its essential epistemic significance. The wealth of the past is expressed by excitement in the present and the transmission of that wealth is expressed not by the amount of verbalized information which the child can produce on demand but by his manifestation of a constructive excitement.

§ 14. Culture and Access

The educational significance of the mass media lies paradoxically in their non-educational motivation. Whether the motivation is commercial as in one half of the world, or political as in the other they are certainly not designed with systematic educational intent. For this very reason they escape the influence of an educational philosophy which has made textbooks so tedious to most children. And because they can be switched on and off they can escape the odium of the imposed time-table. Their content is often meretricious, false or downright pathological, but so too is much of our culture. Our children's exposure to these media is mostly beyond legal control and often beyond parental control. It is a sample of our culture, albeit a far from representative sample, to which access is virtually unlimited.

§ 15. Access and Awareness

It would be very difficult to estimate the relative influence of the uncontrolled stimulation of the mass media compared with the controlled stimulation of conventional educational media in determining the state of the child, except by rather artificial test-measures. But it is not axiomatic that the two are necessarily in rivalry. This is no simple relation of bad to good. Many educational systems instil doctrines which are anathema to others and would be judged as more evil than uncontrolled mass media. We must deal with the world-situation as it is. Enlightened education is still a rare commodity and any planning to extend it must inevitably encounter opposition. If our views are as enlightened as we think we need not only to apply them but to make others aware of them in terms which carry conviction.

§ 16. Awareness and Knowledge

And here we come to an important educational potentiality of mass media. Because mass media produced anywhere can sooner or later reach anywhere, whether by direct transmission, by cinema circuits, by satellite, video-tape or magnetic tape-recording, by discs, magazines, or other means, there is a widely scattered and quite unpredictable access to countless individuals all over the globe. This by-passes all formal educational systems, political controls, censorships and frontiers. The interesting fact about any genuine individual is that he has more in common with any other genuine individual than with any mass. And an educational concept which brings to the individual a knowledge that human identity resides only in individuals can be a very potent stimulus to self-discovery.

§ 17. Knowledge and Science

The simple implication of this concept is that the most powerful instrument of education is the assertion of truth. And we need to assert only a very elementary arithmetical truth namely that every member is made up of ones. Without the ones the many does not exist. Any collective policy on behalf of the many but prepared to sacrifice the ones in the interest of the many is therefore self-contradictory. What is perhaps less obvious is that a number cannot be formed from ones unless the ones are distinguishable. It is meaningless to ask how many drops of water there are in a glass of water. And every fact of history, however many ones are involved, is a product of interactions between distinguishable ones. Not uniformity but diversity is the basic fact on which science is founded.

§ 18. Science and Mechanism

The concept which I have tried to develop here is ultimately one of educational economy but not merely for the sake of saving money - rather for the sake of saving man. And I take "men" to include not only children but parents, teachers, administrators and legislators. For there is an enormous wastage of human living-time in our methods of planning, organizing, providing and testing education and so far we have scarcely begun to use educational technology to reduce this wastage and so allow ourselves and our children more genuinely educational time i.e. more moments of creative excitement. Our culture failed badly in its first encounter with the machine. The machine was hailed as emancipating man's muscles from grinding toil but it was allowed to imprison him in a factory-system regulated by mechanical clocks.

§ 19. Mechanism and Philosophy

I have suggested that education needs a new philosophy of time in order to allow the individual to develop his own momentum of creative excitement at a tempo which enables his own biological clocks to engage with but not to be continuously over-ruled by the tempo of social clocks. And Since this intermittent engagement is becoming increasingly mediated by educational machinery it is all-important to have the right philosophy for the design of this machinery. This must satisfy two conditions. It must provide access to all the cultural wealth required by the curriculum. And it must provide this access so flexibly that each individual can pursue his educational needs at his own best tempo. But there is also a discipline to be observed.

§ 20. Philosophy and Man-Power

An educational system is a social necessity. It is required to meet the needs of many, and it is paid for by the many. But the needs of the many are satisfied only in so far as each one develops his individual identity. He must not stagnate or waste his resources. A system which allowed this would be self-stultifying. Hitherto the examination system has been the principal instrument for imposing this discipline but it has become monstrously inefficient. This is partly because what it measures has only a residual relevance to the objectives of education and partly because it consumes such inordinate quantities of high-grade man-power that too little time is left to fulfil the objectives themselves.

§ 21. Men and Machines

In planning our educational machinery for the next ten years we shall not necessarily do better by spending more but rather by organizing the system so as to give intelligent teachers and administrators more time to consider what they are doing and where they are going. Many of their present tasks are essentially repetitive and mechanical and these should be handed over to machines, if indeed the tasks can be shown to be essential. If it is worth preserving a large proportion of the labour of examining could be mechanized but it is precisely here that now thought is urgently required. If educational value is ultimately expressed in the state of the child i.e. in the multiplicity of his capacities for constructive excitement it is this state which needs to be assessed.

§ 22. Machines and Information

The conventional examination is a poor measure of this state and the psychometric test is even worse. For in neither of these can the child demonstrate his participation in the moments of culture which define the curricular content of the test. To mechanize it would only make it still more unreal. The only adequate instrument for obtaining precise information on a human achievement is another human being, but only if the conditions allow the observation to be adequate. The role of the machine in education is therefore to humanize the teacher by freeing him from mechanical tasks, and so to restore the essential condition of inter-personal relations. And this applies not only to the mechanics of examining but also to that of information-gathering and presentation.

§ 23. Information and Environment

I have spoken throughout of history as the basis of the curriculum but certainly without exclusive emphasis on the remote past. History is forever in the making, and not only on battlefields or in parliaments but also in laboratories and studies, in farms and factories, on the high seas and in outer space. And in considering the media for this kind of information, in which the mass media have unlimited resources to offer, not chargeable to educational finance, we should also include the machinery of modern transport. To develop a curriculum relevant to the world actually inhabited by the child we need to take him from time to time out of school to explore the resources of his environment. But here again the teacher must be set free to explore and assess the educational potentialities of those resources himself.

§ 24. Environment and Administration

This last requirement epitomizes the significance of educational technology in relation to the concepts of administration. Education is a function of a neighborhood. Not only the architecture of the individual school needs a fresh appraisal as regards its disposal of space to accommodate new technical resources and activities but the distribution of educational resources over the whole neighborhood should be regarded as available to all its schools. Here again great economies are possible. But the essential requirement is time for the teachers to explore and assess them. A much greater participation in educational organization and planning by the teachers is the natural corollary of this extension of the schools resources, and an effective data-storage and retrieval system at the service of all.

§ 25. Administration and Responsibility

It will be seen that educational technology can, if rightly used, restore the only sane man-machine relation, viz. one which liberates man from servitude to the material and temporal forces of his physical environment. At the same time by opening the doors and windows of the school it can progressively mitigate the alienation of the curriculum from the environment. This could be its most significant consequence. For if children do not learn that they have a stake in their own neighborhood and a responsibility for it why should vandalism surprise us? When the state insists on compulsory education it automatically removes a portion of parents' responsibility. If its machinery fails to develop a love of home and habitat why should it expect a loyalty to more remote abstractions?

SHAPING THE MIND: COMPUTERS IN EDUCATION[1]

by Ralph W. Gerard

Introduction

Bernard Shaw once said, "The reasonable man adapts himself to the world; the unreasonable man attempts to adapt the world to himself. Therefore, all progress depends on the unreasonable man." Science and technology frequently, like the unreasonable man move to change the world, and often violently. Kepler and Galileo set men's static earth spinning through the skies and wrenched his theology irreparably, but this had little impact on the way he lived. The identification and then transmutation of elements stirred men's souls far less, but the successful manipulation of matter, as in metallurgy and synthetic chemistry, has revolutionized his way of living. A century ago, Darwin's insights again shook man's beliefs, this time in the domain of life; but applications to human evolution remain to the future.

The next great disturbance we can expect from science is in the field of mind and behavior and it will come from the application of behavioral science, mainly in education, more than from theoretical advances in it. The great computer systems that von Neuman sparked supply the technology that will give man control of the mind, as Pasteur's germs and later antiseptics and antibiotics gave control of infection and as Mendel's breeding can control species. Every important scientific achievement has been either a basic understanding that toppled man's beliefs or an applied outcome that recreated his environment, or it partook of both. The impending upheaval in information handling, in ways of thinking and communication, in molding the mind and even the brain, in setting goals and shaping behavior, promises to be the greatest that science has triggered. Man will live very differently as a result of it. We must face up to many disturbing problems; not least the ethical one of mind manipulation.

This essay concerns the technology of human behavior. It faces, first, the value problems involved in tinkering with man's mind; second, the biological approaches to altering behavior and the accompanying brain changes; and third, the impact of computer technology on the far-flung educational processes and establishment. In closing, the longer vista of social consequences is glimpsed.

Values

It is easy to see the limitations of the beliefs--superstitions we are likely to call them--of primitive peoples, but our own convictions also tend to be the more compelling as they are based more on tradition than on experience. As Brock Chisholm, a wise psychiatrist and first Director General of the World Health Organization, wrote: "For most people conscience is something that is not questionable--that gives an answer without thought--that is a feeling, which produces in relation to certain ideas, or certain forms of behavior, a feeling of virtue or, on the other hand, a feeling of guilt or shame. For most people this voice, which is internal, is accepted as ultimate authority, their basic authority. It occurs to relatively few people that the language in which conscience speaks is for each of us entirely accidental. It is determined by the family in which we were brought up and by the attitudes which were about us when we were small; and largely its development is finished by about six or seven or possibly eight years of age." (1)

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[1] A somewhat abridged version of this paper was published in APPLIED SCIENCE AND TECHNOLOGICAL PROGRESS, A report to the Committee on Science and Astronautics, U.S. House of Representatives by the National Academy of Sciences.

To make the issues that the new technology must raise crystal clear, I shall take a strong polar position in favor of activities usually denigrated by such terms as "brain washing", "indoctrination", "invasion of privacy". These terms suggest "man's inhumanity to man"--the using of a person as an object to serve the selfish aims of the user. But not all aims are selfish; a surprising number of man-manipulators are highly altruistic. They operate for what they believe to be the best interests of their targets. The parent, the teacher, the preacher, the doctor, the advisor or guide in general, attempts to mold the person or direct his behavior; if honorable, this control is intended for the benefit of the controlled; if wise, it is in fact so.

Indoctrination

The whole enculturation process is one of indoctrination--in this culture to accept that the word for a furry, purry animal is "cat" spelled with three letters with certain sounds; that a head nod means "yes"; that $2 + 2 = 4$; that every seventh day is special; that a lady is ushered through a door by a gentleman; that communism is bad and (mostly) that either the Democratic or the Republican party is good; that certain ways and values are preferable to others. Without such common acceptances a coherent society could not endure; indeed, with strong subcultures developing in which some of these are not shared, society is today under a severe strain. Yet none of these is an inborn or universal verity; what is inborn is a complex highly malleable system. Normal human babies can learn all these conventions; simian babies can not. Even the mathematical equation varies in its symbols, and all differ among cultures, even to the extent that an adult is quite unable to change. A Japanese, unless raised on our culture, never really masters the "r" and "l" phonemes, nor can an American sit comfortably on his heels, as can an oriental. City children rarely overcome a fear or unease with farm animals, theists and atheists do not easily enter the world of the other, oriental bathing and toilet habits disturb the occidental, and few Americans enjoy fresh mealy worms or fried grasshoppers, as do many aborigines.

The problem is not with indoctrination as such, we cannot have a civilization without it; the problems are rather those of the means of indoctrination and of the control of these means by whom and for what ends. We think of the hucksters, the con men, the dictators, the zealots, even the bad parents, who use subtle or harsh means to bend others to their purposes, which we judge bad by definition (exploiting the object) or by our own values (dishonesty and force are unacceptable). Printing and publishing, radio and television, public address systems and mood music and trickly lighting, all extend the reach and effectiveness of indoctrinator or charismatic leader; increasing behavioral science, giving to the "Menschenkenner" the added understanding of man's drives and emotions and how to play upon them more certainly, will similarly increase his power and control.

This is the universal problem of increasing science, of more powerful means to a wide spectrum of ends. Though many have been concerned at past achievements of science, and a few have actively opposed them, the bulk of man-kind is eager to move from savagery to civilization, from the naked perilous inarticulate existence of "natural" man to the comfortable protected information-overflowing urban life of the "advanced" communities. Nor have men been able to reverse the direction of change; science pushes the groups that have embraced it on an exponential curve of autocatalysis. Education, as maker of the minds of men and vessel for the social transmission of all culture, as an accelerator of acceleration (a "jerk", $\frac{d}{t^3}$), is doubly powerful--and dangerous.

Control

As any system becomes more complex and integrated, the interdependence of the components increases and the influence of the whole on the parts does likewise. This is true for organisms and for societies (2,3). When we come to depend on mass supply of food and clothing, of power and transport and communication, we also become more dependent on the men and machines dealing with these commodities. A widespread airline strike or power failure is devastating to great cities, almost unnoticed on small farms. To the extent that parents have, by choice or law, stopped home-tutoring of their young in favor of community schooling, they have relinquished control of their children's formal education--and to the extent that family groups have yielded to peer groups they have relinquished control of the total upbringing.

All this is not necessarily bad; much is excellent. Authors and teachers, with the aid of books, can offer an education beyond the reach of any solitary parent. Children of foreign parents or those of one native subculture can learn the ways of another culture only from contacts outside the home--though this process often creaks badly at present. The mass media certainly shape the development of a generation and perhaps, though this is freely questioned, more for better than for worse. Their control is in the hands of a few men who are committed by the rules of the game to a successful financial operation of these subsystems, whatever other goals are kept fresh; where profit is less crucial, other values should gain.

It is a biological truism that the organism more fitted to an environment is more likely to survive in it, and the social evolution of institutions is basically similar. Large systems can develop subspecializations and do more things more effectively (and economically) than can small ones, and great corporations continue to spring up and flourish in industrialized countries, whether aided or restricted by public policy. The worry, of course, is that control may become so centered in government itself that a power elite can dictate to, rather than be instructed by, the citizenry. And control of information and of education is absolutely crucial in manipulating people's current and long-range attitudes--witness the high priority of broadcasting stations in a revolutionary coup. Partly for this reason, education in this country has been kept mostly in the hands of very local groups, with little support or direction from the federal government. This has permitted, indeed, great variation in the education experience of our children; but the evidence suggests that much of this variation is in the substandard direction.

California, with a population of approximately 18.6 million and some 4.4 million children in its schools through grade 14, is larger than most nations. Expenditures run about $50 over the national average annually per pupil and, despite great local differences within it, the state does set many educational norms, as by choosing textbooks. Such

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norms are not generally regarded as pernicious, nor need federal standards be so. In France, long the cynosure of the cultured world and still muddling along without falling into either totalitarian extreme, a minister of education could say, "At this time of morning I can tell you that every third grade class in France is studying the subjunctive of the verb 'to be'" (4). This seems to us too great a regimentation, and indeed France has suffered in consequence; but when we look at the caricature of education presented too often in this country by fearful, ignorant and often hostile teachers in shabby quarters and with almost non-existent resources to unwilling, scornful or openly rebellious youngsters from racially or economically underprivileged sources, we may be less fearful of the influence of federal education.

Nor has big government made a bad record in education and education-related activities--witness NSF support of high school science curricula (5). The great granting agencies in Washington have contributed to our major universities so extensively that nearly all would collapse if federal funds were sharply curtailed. Yet, while supplying the means--building, equipment, personnel--federal officials have avoided prescribing programs. The university scientists of this country are so pleased with their direct support from Washington that many oppose any strengthening of the role of their own instutution in the distribution of federal resources; and not only the legislators and public but many in academia as well begin to suggest more instances of centrally planned programs. Moreover, the academic world has come widely to respect the competence and integrity of those administering the government agencies in this area--from the early days of ONR right to the present. Why should they not--these men have come from and return to the academic ranks and they consult intensively with the men and institutions using the resources they dispense.

Actually, mass development of technologies of communication and, so, of education have led to the loosening of centralized control of men's minds. Printing and books, significantly starting with Gutenberg's Bible, are credited with the successful revolt of the people from tight clerical rule. The typewriter and telephone, possible only with massive conformity, have enormously increased the flow of individualized messages with, essentially, no constraint on their content. Videotape is rapidly reaching the stage of home (or school) production and use, with individual (or local) decision as to what is produced and presented. (Incidently, home movies have long been with use but few of the local productions attain willing audiences even without charge, as compared with the mass-produced and often tactless professional ones for which people pay admission.) When the great computer systems and data banks and networks are in operation, there should be greater freedom of local content choice and even production than is presently the case with packaged books or tapes or movies. Teachers will continue to prepare the messages, however complex or universal the medium for their presentation.

Privacy

The spectre of Big Brother in 1984 is real--and indeed "eternal vigilance is the price of freedom"; but technology can aid vigilance as well as power. It is feared that great data bases of information about people will provide dossiers to be misused by the unscrupulous (e.g., b). This is a legitimate fear, but security of information is easier to maintain with a computer system than with present document files, and checks on human controllers of such systems are also possible with split authorities and with technology itself. We hear a great deal today about individual rights and the infringement of privacy, but very little of the advantages of the inevitable relinquishment of certain privileges as men crowd into social living. As Ogburn wrote thirty years ago:

> A very good illustration is one discussed in another chapter, that of securing useful information about an individual. In a stable community with aggregations of population little larger than a village an individual becomes generally quite well known even to his minute idiosyncrasies. The requirements of the task which he or she is sought to perform are also generally known. The situation is quite different in a complex society undergoing rapid change with large populations and a good deal of mobility. There is thus an urgent demand to know more about indivuduals. So there are psychological tests, school grades, fingerprints, lie detectors, case history records, vocational guidance agencies, etc. The influences of these various inventions all flow into the same groove leading toward more information about the person concerned. It is the social need that determines the groove. (1a)

The battle of fences versus open range, between the sheep and the cow man in the opening west, was a perfect paradigm of the problem of private versus public domain. Society did not hesitate to impose on individuals vaccination and quarantine, since an infected individual was a menace to others (at the sub-human level, herds of infected cattle, for example, have been ruthlessly slaughtered). It imposed schooling, since an unenculturated person was similarly a threat to others; it specified fire or driving or sanitary safety standards on the property of an owner for the protection of others. Society, dependent on customs and laws for needed conformity, applies informal or formal sanctions to transgressors. We find the gain possible from the social contract greater than the sacrifice it requires.

Yet there is now an outcry against asking or testing for certain information for census purposes, for schooling and placement evaluation, for taxing and credit, for legal and law enforcement needs. Because information can be used unscrupulously, the old adages urging maximum information for the electorate and honesty as the best policy seem to be in eclipse. It is forgotten that in most cases where "prying" into the "affairs" of an individual is resented because there are dirty corners that violate social or legal norms - granting that some "play" in the system is desirable. Our [illegible] against self-incrimination are properly intended to protect against coercion, especially by physical force. Should they, however, really prevent a responsible law enforcement officer from obtaining a drop of blood for an alcohol test of a driver involved in a traffic accident? Recognizing its high, though fallible, performance (7,8), why should not a lie-detector test be given and the results, expertly interpreted, be used in reaching decisions? Why should a statement heard with the naked ear or an event seen with the unaided eye be legal evidence, but the same information gained with a microphone or an infrared scope be inadmissible? Is not the complaint rather with incompetent or criminal use rather than with the technology; and is not the answer improvement rather than abolition - which is clearly impossible, especially against those flouting rather than supporting the rules of society.

A full and thoughtful treatment of the technical, psychologic, social, and legal aspects of the ancient and modern problem of privacy, disclosure, and surveillance has recently been published (9). The conflict of rights between individual and group is clearly recognized (see also 10, 11, 12), and the lag in legal attention to the progressive invasion of privacy by technology during the decades from 1880 to 1950 is documented. Westin also points out the importance of official blinking at violation of generally rejected laws, as those against gambling or prostitution, and justly states (p. 1046), "Only those who can sustain an absolute commitment to the ideal of perfection can survive total surveillance. This is not the condition of men in ordinary society." Clearly, an alternate remedy in such cases is a more realistic body of law, both as to what is proscribed in individual behavior and in the investigation of individual behavior. Many feel today that snooping has gotten out of control and wish to return to the level of privacy possible in the 18th century. Since the integrative forces of society inevitably increase as does interdependence, this is unrealistic. Surely abuses can be checked, but what is regarded as crucially private is also changing. Full candor is today socially intolerable, but candor is seemingly increasing in human relations - witness responses on sex, finances, beliefs not only to anonymous pollsters but also to acquaintances in psychotherapy or sensitivity-training groups, now so popular - and might conceivably obtain even in diplomacy. At least a study of foreign officers in our Department of State suggests that greater candor would be desirable (13). We may indeed be moving toward "preventive mental health".

What is needed is a less confused information flow and clarification of its acceptable uses. In any event, technology in the behavioral science area can be used with increasing power and reliability to reveal unacceptable attitudes and acts of individuals. Or acceptable ones; the use of a reverse lie-detector situation has been suggested, to allow a nation's leader to prove to other nations by "truth demonstration" that his public statements are indeed sincere and not diplomatic bluffing (14). And technology can offer counter-measures, as jamming, to illicit surveillance.

The above treatment is far too brief an entry into a great and complex, as well as emotion-laden and legally bristling field. It is intended to challenge contemporary attitudes and so promote objective study, not to disprove them by further rhetoric.

Brain Changes

This extensive foray into value problems was essential before examining the promise, or threat, of the new knowledge and technology that is upon us in the area of brain and behavior. Every advance opens clear possibilities for application that impinge upon strong beliefs or emotions. My primary concern in this essay is the enormous impact on education, and so on all facets of our life, that new information handling technology will make possible; but, perhaps partially for desensitization, a look first at more direct ways of affecting the nervous system is in order.

The brain is in essence a giant network of billions of nerve cells, or neurones, of many types, but each possessing long, hairlike extensions to connect with many others. Electro-chemical changes sweep along these connections to activate or quiet neurones - which in turn increase or decrease their own activity and the pulses they emit. The environment, by playing upon sense organs, initiates patterns of input messages along sensory nerves that specifically represent the situations which triggered them off. These sensory inputs activate particular groups of neurones which continue to send further messages to and fro, with time and repetitive signals often reverberating along selected channels for long periods before fading out, or discharging along motor nerves to produce muscle movements and other kinds of behavior. One might think of an outside signal which starts the church bells of a village chiming, and then the bells leading one another into and out of a melodic ringing of changes.

Since neurones are living and highly labile in state, a given sensory input does not always evoke an identical internal activity pattern or an invariable behavioral response. Just as muscles perform better after a warming up period, show fatigue after maintained activity, and hypertrophy (a kind of learning) with repeated use; so neurones respond more or less easily depending on their own past activity and improve their performance or repeated experience. Far more than muscles or many other organs, nerve cells are highly sensitive to small electric currents, to a variety of chemical (as drugs, hormones, toxins, neurohumors, and other normal or foreign substances) and to changes in blood supply or its contained nourishment. All these, as well as past experience, can greatly alter the amount and kind of activity set in motion by various external situations (15, 16).

Biological Control

Many potent drugs are now available for many effects on behavior; how they affect the brain so to alter behavior is rarely clear. Sedatives act to decrease activity, excitants to increase it, most drugs have mixed and complex actions. Yet even a "sedative" barbiturate given to solitary mice, puts them to sleep; given to mice in "social" groups, often rouses them - much as alcohol does to man. Narcotics also have multiple effects, as do tranquilizers and the various "psychedelics" coming into widespread and dangerous use. Many drugs have long range effects, especially after repeated use, associated with habituation and addiction; a few can produce enduring change after a single dose. Psychotic and neurotic patients today are regularly given treatment by tranquilizers and related drugs, and this group has become, after antibiotics and drugs affecting blood pressure, the most widely used pharmaceutical - one-sixth of all prescriptions. In 1964, 140 million doses (costing half a billion dollars) were dispensed in response to legitimate medical prescriptions (17). A large illicit traffic, moreover, exists in these chemicals as well as in marijuana, LSD, "pep pills", the morphine group, and other drugs used by physicians little or not at all (18). Here, clearly, are powerful ways of controlling behavior by direct action on the brain.

Behavior can be also specifically manipulated by applying electric currents or drugs to chosen regions of the brain. This requires, mostly, the placement during an operation of fine, stimulating wires, electrodes, or tubes, chemtrodes, and so is less immediately at hand than the usual use of drugs; but procedures are relatively simple and *could* be applied widely, and the effects are dramatic indeed. Stimulating one small region in the base of the brain will make an animal drink lethal quantities of water; stimulating a nearby one will cause it to thirst to death. Other centers control eating or running or fighting or sex or other activities. A house cat with the appropriate part of the brain activated attacks ferociously; a wildcat, with this region suppressed or destroyed becomes tame. Animals will forego food and sleep for days to press a lever that delivers stimuli to "pleasure" centers in their brains - probably the same ones which, stimulated in humans, lead to strong sex-related sensations. Still other regions evoke in man sensations of vision or other senses, or cause past experience to unfold as vivid memories, or initiate complex hallucinations or other abnormal experience or behavior (19, 20). Here, also, is a wide avenue to control of the mind.

Many other agents can be applied to the body to affect behavior: sex hormones that masculinize or feminize, thyroid that heightens activity, adrenalin that generates anxiety, strychinine that raises irritability, many others. Mention might be made here, though the underlying basis is presented later, of claims of drugs or brain extracts that enhance learning or memory. Much research is in progress supporting or, mostly, denying the possibility that extracts (supposedly of RNA) from brains of rats which have learned a particular performance, injected into the brains of naive animals, decrease their learning time for this performance (21, 22, 23, 24). One set of experiments, for example, claims that extracts from rats taught to turn right in a T maze hasten the learning by injected rats to make a right turn, slow the learning of a left turn; and extracts from rats trained to turn left have the reverse effect (25). Confirmation is certainly required here. Hypnosis also needs mention, but cannot be adequately discussed; it is more related to learning as such.

While drug use is widespread, other manipulations mentioned above are likely to remain as laboratory or hospital curiosities for the forseeable future. Somewhere intermediate is the control of brains by development. Controlled alteration of genetic materials by chemical and other agents is some time off, but there is no question that selective mating now could shape future generations of men as it has done for plants and animals. With the arrival of sperm banks and ovum banks, with improved means and growing acceptance of fertility control and birth regulation, with strong pressures for quantitative limitation of population now widely recognized and qualitative selection more possible, an effort at genetic guidance for improved "intelligence" or artistry or benevolence or flexibility for further evolution (surely desirable) or what you will may not be far off (26). The ethical question of tampering with human evolution is spurious; we are doing so strongly already. Modern medicine, public health, social welfare, are decisively altering the reproductive balance between varied gene pools - and not toward enhancement of the species. It is not too early to give serious thought to preferred directions of guided reproduction, for the means are upon us and almost surely will be applied, wisely or foolishly.

Behavioral Control

When messages pass from one neurone to another there is a small easing or enhancement of their future passage over that particular connection. Frequent repeated activity thus, like a rivulet deepening its bed, channels certain easy paths for itself. When habits form, behavior is conditioned, experience is internalized, there are real and enduring changes in the nervous system (27). Baby chimps, raised with no opportunity to see patterns for a couple of months, are unable to discriminate objects when later given the opportunity. They are functionally blind; the absence of normal visual exercise during the early development of the brain led to defective connections dealing with visual messages (28). Recently this defect has been directly demonstrated, not only in brain structure (29) but also in its functioning. Microelectrodes have been put into or near individual neurones in the visual cortex of kittens, directly measuring the traffic of nerve messages in and out. Normally, a tiny spot of light on corresponding points of the right and left retinas starts messages in nerve fibers that reach the same few neurones in the cortex. Mostly, such neurones are stimulated to send on their own messages about equally well by those arriving from either eye. If, however, one eye is kept covered for five weeks after birth and then uncovered, messages from light run up to the cortex in the normal manner but fail to activate the cortical neurones on reaching them. And this defect persists; the covered eye, or rather the brain it serves, remains blind (30). In the same way a baby with "cross eyes", so that light from a given object doesn't fall on equivalent retinal points and the baby sees double, comes to neglect the messages from one of the eyes. Unless corrected early in life, the "suppressed eye" becomes blind.

Many other studies point the same way and even have demonstrated structural and chemical changes associated with activity that relate to the functional changes just mentioned. The brains of highly inbred strains of rats are remarkably uniform, so consistent differences found between groups kept under one condition or another can be highly significant. In series of tests, some rats grew up in an "impoverished" environment, one to a cage, no "toys" or handling, unchanging environment with minimal sound or light; others were in an "enriched" environment, playmates and play objects, much petting, etc. The cerebral cortex averaged about 5 per cent thicker in the enriched group and some important chemicals were more abundant (31). It needs no great extrapolation to see why children reaching first grade from environments in which the written word is nonexistent and the spoken word almost equally so are disastrously handicapped for their schooling experience, nor to appreciate the great potential of remedial pre-school programs such as "Head Start". Some of the chemical changes found in the brain in relation to learning involve the production of more or different RNA molecules and of the proteins and enzymes these in turn produce; and many scientists associate memory with these particular substances - perhaps acting indirectly to facilitate the passage of messages from neurone to neurone (32). Hence the attempts to aid learning and memory (even in man) by RNA and comparable injections.

Whatever the biology involved, experience can strongly influence the brain. Not only does deprivation limit brain development, desirable activity enhances it. As training in sports or other physical activities markedly increases skills and performance, so appropriate exercise of the brain improves intellectual skills and performance. A good coach and a good teacher have comparable roles - to guide learning by well-chosen experiences. Psychiatrists and clinical psychologists have long offered controlled experience in psychotherapy of various sorts to aid the mental health of adults and children. No one knows what improvement in performance could be reached by an average child given better learning experiences, but competent judges have guessed several fold! At least, I.Q. differences of 10 to 20 points or more have been reported as induced by environmental conditions (33). The answers, of course, will be reached by really examining and experimenting with the total educational experience and carefully studying the outcomes (see also 34. Skinner quotes Pascal: "Habit is second nature which destroys the first. But what is this nature? Why is habit not natural? I am very much afraid that nature is itself only a first habit as habit is a second nature.") Since so much of present education is mortally ill,there is almost no danger of harm in careful experimenting and vast promise of good. And at last the technological means of adding science to art in education are available.

Technology and Education

Learning is the modification of behavior by experience; and formal education is a conscious effort to modify behavior in chosen ways by appropriately structuring experience. This is indoctrination, however done; it might as well be done with some elegance. Elegance has mostly not been the case. Goals, beyond the most elementary rote learning of the R's, have rarely been clear; learning theory, or even heuristics, have been almost non-existent; educational procedures, when happily good, were so because of gifted individual teachers; leadership and thoughtful innovation were rare and often frowned upon by the community; perhaps most depressing was the almost total absence of self-examination of the process of education or evaluation of the product. From educational technology must come an educational science to supplement its art.

With school people given low pay and, often, regarded as lackeys of the parents or town fathers; with the swelling needs for teachers met all too often from the less motivated and able; with slender resources, crowded classes and heavy "administrative" overload; with students moving in a solid phalanx through a uniform curriculum of fixed content and length for each class - although differing abilities and achievement from subject to subject often found grouped in the same activities children with an effective range of seven years or more (35); with even the best willed elementary teachers devoting, on the average, under one seventh of pupil-contact time to actual teaching and this divided among 20 to 40 or more children, of whom progressively more in present schools resent being there; with all these adverse factors it is perhaps, like Johnson's dog, more remarkable that schooling can stand on its hind legs than that it does so poorly.

This country has always been convinced, as part of its democratic heritage, of the importance of widespread education; and it has been convinced, no less, that this should be kept in local control. As masses grew and mass schooling became reality, however, local resources could not keep up and today the small community, unless an exceptionally wealthy one, is unable or unwilling to buy quality education. Like the impoverished buyer in general, these pay more money and receive inferior goods. As former Commissioner of Education, Francis Keppel, has emphasized (36), quantity rose and quality fell.

The case of instructional television is illuminating. This clearly valuable resource has more or less failed in this country, while highly successful in many others (both advanced, as France, or retarded, as American Samoa, 37, 38) where it developed on a nationwide base (4). President Johnson stated in a release, November 26, 1966:

> During my recent trip to the Far East, I visited the educational television station in Pago Pago, American Samoa, and saw how television is being used to improve the level of learning in elementary and secondary schools.
>
> I believe that educational television can play a vital role in assisting less-developed countries in their educational effort. These stations can be used for adult education and information programs during evening hours. Community leaders can use these channels for discussion of important public issues.

Local units here have proven too lacking in resources of money and skill to turn out even creditable products; and truly superior ones are essential even to win a fair test in the face of teacher conservatism, let alone to do a better educational job. The NSF-supported science high school curricula, requiring resources not locally available, are an example of a nationwide effort that has had considerable success in this country.

In the horse and buggy days, local artisans could supply the individualized needs of their townfolk;when technology presented the gasoline buggy, the great nationwide automobile industry soon sprang up and offerings became more standardized. Yet who would surrender the superhighway and easy transportation (yes, even in rush hours) for the dust, mud, and manure and the clop-clopping trips of the past - except in moments of nostalgia. More people are able to get about on their individual errands since road transportation became mechanized and centralized than was remotely possible with individualized resources. More standardized resources thus permit more individualized uses. (Much the same point is made in the just released report on "Public Television", by the Carnegie Commission (39). New problems have, of course, arisen; few qualified judges doubt that further science and technology will, if given a chance, resolve them.

The point is made in an essay in this volume (40) that social problems which resist social solutions may yield happily to new technology. This may well prove the case for education. The blackboard, the slide projector, the television screen, even the book (at least in early stages of learning) are at best aids to the teacher, who remains the focus of the pupil's learning. When programmed instruction made a stumbling entry, even when the vastly greater potential of computer programming appeared, the emphasis remained on the teacher - witness the terms *teaching* machine and computer-aided *instruction*. But, of course, the learner, not the teacher, is the proper center of focus; the teacher - except as he helps set the goals of education, which occurs essentially only at the highest reaches of the university - is just a learning aid to the student. Educators do prepare curriculum content and teachers do give their charges more than policing and drill; they offer important emotional interactions, especially in lower grades, and intellectual interactions, especially at higher levels. But the former duties tend to overwhelm the latter and, if technology could take over the lesser jobs, fewer and more gifted humans would be able to do better the more creative jobs. Computer systems have reached the stage where rote drill, individualized tutoring, even socratic dialogue is possible between machine and user;when such systems enter wide use the teacher will no longer be essential in most phases of the actual learning process - indeed, the organized school itself may undergo metamorphoses or disappear.

Humans will always have to set the aims of education and to create the materials and sequence them for the learning experience so as to approach these goals. Humans will also always have to interact as humans with the young; infants, animals or man, given full physical care but kept in biological and psychological isolation fare badly, if they survive at all (41, 42). But different humans may well serve the separate needs, via existing or different institutions, and most of the direct interactive learning experience, especially at early levels, can then be presented by a computer-tutor rather than a human robot.

The present computer - and new generations continue to arrive every 2.5 to 3 years - can already handle dozens of terminals at the same time, responding promptly (under a second) and individually to the specific needs and performance of each user. The terminal hardware is now so convenient and the special languages required for man-machine communication so near natural language, that a completely naive user can be guided by the system itself to proficiency in use and mastery of a chosen subject, without human aid except in emergencies. Computer-aided *learning*, CAL, is rapidly penetrating schools, exploring with special vocational and professional groups, and flirting with total communities. Although hardware must and will improve in performance and, even more, in cost characteristics; the real problems today are in software, in content materials and, to a lesser extent, programs for computer performance; and in organization for effective use. Involved here are: curriculum building; arrangements for rewarding the creation and dissemination of CAL materials; developing comprehensive shared data banks; establishing compatible and convenient information networks; exploring the problems of widespread cooperation of institutions and teachers in producing and using educational materials; productively integrating books (via microfilm), sound records, movies, video materials, any recorded form of man's collective experience and creations, into computer-mobilized resources. Included also are: better understanding of the learning process and learning how best to aid learning (e.g., 43) - when to instruct or drill or examine or answer or discuss with the student; devising and using satisfactory criteria and measures of the behavioral gains that education is supposed to be furthering. Many of such needs are not new, nor unique to CAL; what is new is a dawning science that makes it possible to formulate incisive and meaningful problems in the field of education and reasonable to expect that solid answers will be forthcoming.

CAL

In order to build a course, or a shorter instructional block, for CAL, the objectives of each exercise must be distinct, the reasoning sharp, the logic sound, and the facts and responses correct. An hour's interaction may require one or two hundred hours to prepare; but in the course of this, involving preliminary testing on students, fuzzy or dull or otherwise inadequate portions should have been corrected so that a really incisive educational instrument is the result. This can then be used with unlimited numbers of students, located anywhere - at homes, in other parts of the country - at any time and with any amount of repetition. Further improvement and updating is as simple as typing a few lines; and many alternative presentations will surely be developed as the scale of use permits. The limited experience to date indicates that students cover materials (skills and understanding as well as knowledge) faster (three to five times have been reported, 44 but see 45, 46, 47) than in ordinary classes, to a higher criterion of mastery, with better retention, and with great satisfaction. At college level, more complex and instructive problems can be assigned. Children and adults, alike, are led on as in a game and often, if permitted, work at a course hours on end - somewhat reminiscent of a rat stimulating a "reward" center in its brain by pressing a lever, or a pigeon similarly "earning" grains of corn.

The computer can keep a record of the full interaction with the student, with two, perhaps three, major gains. For the educator, the microrecord of performance allows easy and pinpointed experimentation with alternate ways of presenting materials of various sorts to various kinds of students, thereby rapidly improving understanding and practice in education. For the student, a record of what he has learned and his particular learning idiosyncrasies can govern the heuristics (rules of thumb) used by his "tutor" - whether the computer responds more actively or draws out the student, whether it tells or asks, whether ideas are best presented first by example or introduced at once as general principles, whether small steps and repetition or great mental strides are needed, whether visual or auditory presentation is most helpful, and so on. It bears reminder that two children of equal "intelligence" may vary a thousand-fold in the ratio of one particular ability to another. Little of this is yet being done, but many sparks are lit and there is no question of technologic (if not yet economic) feasibility. The third gain of the performance record is that, at the end of a block, the student has in fact demonstrated mastery and has passed his examination - the computer, thus, can teach and independently certify achievement.

Many other gains should follow. With highly individualized instruction, curricular units can be made smaller and combined, like standardized Meccano parts, into a great variety of particular programs custom-made for each learner. Unplanned repetition and waste, greatly present in higher level courses at least, should be eliminated and content much better tailored to the intellectual shape and goals of each user. The opportunity for a student to learn pretty much at his own convenience of time, place, pace and procedure is hard to over-valuate and, although the need to gather at a school may in time disappear, two or more students could easily work together at a terminal (some studies suggest this is effective as well as economical, 48), and two-way or conference-type interactions with teacher or total "seminar" groups are also entirely possible. The altered roles of teachers have already been mentioned; where the teacher does remain in the immediate classroom situation, relief from routine chores should be most helpful. Finally, with spatial gathering minimally necessary, and educational demands and the means to them more widely interchangeable, the single school and classroom and promotion might well give way to regional or state or national educational systems and graduations, or other certifications of achievement - as in the British "University of the Air" (49).

It would take us too far afield to examine present efforts in CAL; many, notably one at Stanford, are described in recent publications (50, 51, 52, 53, 54, 55, 56). At the university level the Interuniversity Communication Council, EDUCOM (57), is rapidly bringing the institutions of higher learning of this country into a working information network; and the larger state systems, as the University of California or the State University of New York, are developing supporting INTRACOM systems. I may be permitted, however, a passing reference to the present use of CAL at the University of California; and to a Lifetime Learning Center, "an ambitious attempt to consider the community as a total information system, within which all the functions of teaching and learning are carried on in both formal and informal settings," in the planning stage with UCI, the Irvine Company, and the General Learning Corporation as cooperating participants. (Parenthetically, the important and related developments in the uses of computer systems in administrative matters at schools, for generating true systems planning by these institutions, in research to aid hospital operations and medical practice, and particularly, still within the education arena, to mobilize library documents and eventually to deal with the contained matter directly, all omitted here, deserve separate attention, 58, 59, 60, 61, 62.)

U.C. Irvine has been committed to full utilization of computers from its inception. By the time faculty began to arrive, two years ago, a cooperative agreement with IBM made available a moderately powerful instrument, housed and staffed in trailers at interim quarters, and half a dozen on-line terminals were active. Now, partway through our second academic yar, 18 terminals are kept active 70 hours a week and batch processing is carried on at off-hours. Course enrollment has been computerized from our opening and academic records and reports are handled with this aid. Some accounting is automated and more administrative and library functions are being programmed. CAL has been used by about half of our 1600 lower division students, for short or long times, in such course work as: introductory psychology, economics, biology, information and computer science; and in remedial mathematics, English, history and government. A modified and a new computer language have been developed for computation and they are widely used by advanced students and faculty in their research. Well over half the faculty is using a computer in research and some fourth are concerned with CAL, many actively engaged in programming course content. A new system, now being installed, will soon permit the greatly increased use that is clearly demanded.

Costs

In the mid-sixties education has become this nation's largest industry. Many figures in Keppel's recent book (36) support this statement. Half a century ago, the average schooling was through eight grades of elementary school, today it is well over the twelve grades through high school. Some 50 million pupils are today in elementary and high schools and the number is increasing at one million a year; over three-fourths of our population 17 years old or over graduates from high school. A total of 123,000 schools and 2.4 million teachers are teaching 55 million students at a yearly cost of $39 billion.

In 1962 the federal expenditures for education were $1.8 billion (2 per cent of the total federal budget); states' expenditures were $10.7 (34 per cent of their total budgets); local expenditures were $17.9 (45 per cent). The total public and private outlay for schooling (1963 estimated) was $35.9 billion. (A recent article, 63, gives $48.8 billion as the figure for 1966 and adds $12 billion for educational activities in industry.) Total education costs ($3.5 billion) were 1.8 per cent of the GNP in 1943; 3.8 per cent ($14 billion) in 1953; and 6.1 per cent (36 billion) in 1963. The average cost (constant dollars) per pupil-year in all public schools rose from $106 at the end of the thirties, to $259 in one decade and $472 in two; now it stands at $641. Some 350,000 classrooms were built in the first part of this decade and nearly as many more will be needed (even at 30 pupils in a class) during the last half; and the bonded indebtedness for buildings rose $13 billion in a decade, to $17.5 in 1961-62 - with over a half billion interest per year.

Expenditures are far from uniform between states or districts in a state. In 1959-60, the cost per classroom ranged from $3,645 (Arkansas) to $12,215 (New York); in 1965-66 teachers' salaries varied from $4,190 (Mississippi) to $8,240 (Alaska); and the cost per child-year ranged in New York alone from $300 to $2,000 (1962-63) and from state to state from $249 to $749. By 1965-66, Office of Education Title I funds were giving significant aid to state budgets - from 15.0 per cent ($31 million) of Mississippi's to 2.3 per cent ($78 million) of California's. The rapid growth of funds available (from $0.12 billion in 1956, $0.35 in 1961, to $1.5 in 1966; with a total O.E. appropriation for 1966 of $3 and one of about $5 recently passed Congress for 1967) will surely lead to a general upgrading of education and especially to intensive experimentation involving new technologies.

The computer and related industries have burgeoned in the past decade and give every evidence of increasing growth. An informal guess (64) is that the 1,000 computers in this country in 1955 will have risen to 70,000 by 1975. They will be 1,000 times as powerful as now by 1980, completing 10^9 operations per second and at 1/200th the present cost. Large computer memories of 10^{12} bits are now at hand, each able to handle 10^{-3} of the information (non-redundant) in all libraries of the world. The federal government alone spent $840 million from June 1965 to June 1966, running 1,800 computers - mainly for fiscal use.

Transistors and related solid state developments became commercial only some half dozen years ago and gave the decrease in size and power requirements and increase in reliability needed to touch off the computer age. With miniaturization, thin film, and integrated circuits, costs have dropped by a factor of 10^3, and circuitry costs first, now memory costs, are becoming relatively unimportant. An estimate (65) shows a modern computing system (32 K magnetic core memory) now costing $1.5 million to make will soon cost less than one-forth as much. To be sure, as the logic demands rise the load on the computer goes up rapidly, especially when used in an interactive on-line mode as in CAL - the number of branches rises precipitously with extension of modes in a chess game - but simple drill and tutoring is less demanding and, if highly idiosyncratic responses of students are handled indirectly (e.g., 1 per cent are asked for a different response or referred to a teacher), the branching is greatly decreased. In any event, for CAL at elementary levels with multiple access systems in effective use, costs per terminal hour are already below $1 - and children are being taught from scratch to read English in 200 hours (66). This initial estimate has later been revised upward. It probably remains valid if hardware is amortized over 10 years rather than rented. Over time, since human services steadily rise in cost and automated services fall (for computers by a magnitude every "generation" of three years), the cost curves must inevitably cross. Most industries have shifted from 75% labor and 24% machinery to the reverse, education has still to change from the older figure. (See also 67, 68 to the effect that rehabilitation and vocational training can be accomplished at a total cost per student of less than $200, at under $1 per hour.)

Some have estimated the cost of preparing CAL materials at $4,000 - $10,000 per hour on the computer. This seems excessive, even if 100-200 instructor hours are required, plus some programmer and machine time; but even if a figure, say, of $5,000 were accepted the cost is small compared to hardware cost - if materials are widely used. A single hour T.V. program can easily cost 50 fold more and yet be profitable; if a CAL program were used in only 1,000 classes one time it would be entirely feasible. Actually programs could be used more widely and over many repetitions - with easy updating every year or two. I estimated in 1965 (69) that 100 lower division college courses, which should cover present offerings quite well, could be put on CAL for $3 million; even if low by a factor of ten, the cost would still be small. In the lower schools, with more restricted curriculum options, with even greater gains in learning time possible for CAL hours compared to usual class hours, with more pupils and simpler machine demands, CAL should show a great pay-off, both in cheaper and in better education. (The Carnegie Commission incidentally, recommends about a quarter of a billion dollars annually for adequate "Public Television" and something comparable for "Educational Television".)

How soon and how extensively the usual classroom teacher and the usual classroom can be shunted by CAL remains to be seen. If the present school personnel and material (including buildings) were cut to one tenth, some $50 billion a year would soon be released. Assuming a school year of 1,000 class hours for the average pupil, and $1 per hour per terminal, CAL would cost $2,000 per pupil year - some half again the present national average - or $100 billion per year. This limited increase of present costs (at most temporary with improving technology) neglects, however, the more rapid learning with CAL. Even with a halving of learning time (let alone the 3-5 fold reported), CAL would today be considerably less expensive than conventional education. (This neglects other kinds of learning, as social or motor skills or attitudes and motivations which occupy a significant portion of present school hours.) If the present education through high school were dehydrated from twelve years into nine, as is the case in several European countries, the decreased teaching costs and the gain in learning power would yield an annual saving estimated (70) at $15 billion.

Organization

Smaller school districts are unifying into larger ones and minimal standards are being pressed by the states. The O.E. is tooling up to handle the great increase in federal funds, which will surely help to spread and upgrade education. Industry has recognized the opportunity presented by the metamorphosis of education from its prolonged horse and buggy era to a technologically modern activity and is stirring itself mightily. Companies expert in computers, in communication, and in publication and editing have been associating to create independent or subsidiary entities. In the past year over 120 such hybrids have been formed (63), of which the best known include RCA and Random House, IBM and Science Research Associates, G.E. and Time, Inc. (to form General Learning Corp.) Raytheon and D.C. Heath & Co. and others. These, in turn, are establishing ties with educators and schools and universities; and all are looking to federal and other governing agencies for cooperation and support - much as in the aerospace field.

Actually, a new kind of utility is coming into being, with education and entertainment (hopefully more related than in the past) and banking and other information services destined to enter each home via appropriate wall plugs and terminal equipment. The federal government, especially Congress, will be faced with major problems of control, support, and cooperation. Information is the commodity and will be more difficult to handle than objects. When computer programs and data banks, more than particular books or films or tapes or discs, are the crux of the matter, copyright laws, as one example, and property rights between government, business, schools and scholars for another, demand a complete overhauling. Despite McLuhan, the message is our concern, not the medium; and our brains and behaviors respond to the meaning rather than the avenue by which this is received. Much creative study, and top level interaction between government, industry, and education, are urgently needed to effectively channel the flooding opportunities.

Technology and Society

That the new information-processing technology will profoundly alter man's ways, is widely agreed; whether for better or worse is debated. There certainly is a danger of damage by new ingredients in our social nexus. I would call this "social toxicity". Urbanization, made possible by advances in the technologies of housing and transportation and hygeine, in particular, certainly carried unanticipated elements of social toxicity that fostered delinquency and crime and alienation. Perhaps, with communication about to leap-frog over transportation, urban sprawl will decentralize to community spread and so solve many problems. The new ones must then be faced in turn.

An anthropologist left a steel machete with an Andean Indian tribe that had no metal tools, and almost exterminated them: it enabled them to collect large quantities of cane to ferment for an annual "get it off your chest" fiesta and, instead of patching matters up in a mildly euphoric mood, they got into lethal drunken fights. Outcomes cannot be fully predicted, although a growing and sturdier behavioral science will improve prediction (71). My own conviction is that the new will bring far more gain than loss.

Neglecting all else, few men would exchange the human estate, with all its enhanced problems and suffering, for the simian one. Yet there is reason to believe that man's great cerebrum, which makes man human, itself evolved from a technological advance - the use of hand tools (72,73). The new information technology, involving both CAL in educating our youth and a computer-man symbiosis in problem-solving by our adults, might well propel man into a new species. Certainly man must upgrade himself to keep ahead of his automata, and certainly he will be doing very different things soon if one thoughtful analysis (65) is correct: "By 1972, allowing one to six years to design and build automated production systems, a large majority of the nation's jobs now in existence will be obsolete." And certainly CAL offers hope of breaking through our present educational impasse that helps maintain an underprivileged and progressively unassimilable part of our society. It may be the solution to "the contradiction in practice between quality of education and equality of educational opportunity" (36).

Nor have the anti-technological prophets of doom mostly been right - social toxicity has rarely been correctly predicted, the troubles have not been those feared. When trains were coming into use in the 19th century physiological disaster was predicted from moving the body at 20 miles an hour (74); when documents appeared in antiquity a decay of memory was forecast that would "produce only a race of imbeciles", a view supported even by Socrates (53). Change is always disturbing and education, accelerating change, has been an enduring problem to society. A difficulty has indeed been that, "the society which education served has in general been defined by what it has been, rather that what it might be" (75).

Social evolution was superposed on biological evolution when a brain capable of learning and transmitting that learning came into being and made a collective culture possible. Then man interacted with his environment more in terms of information flow relative to energy and substance flow; and, having fairly solved the physical and biological problems of control of his material environment, he now lives in a sea of information that he has created and to which he must adjust. I see the main epochs of social evolution as: the use of symbols; the organized use of symbols, language; the tested organized use of symbols, science; the extrasomatic manipulation of symbols, computers. This technology of information-processing, channeled into education, will be fully as important to mankind as is language or science. Science, like the unreasonable man, will retailor the world to man; yet in an unexpected way, will retailor man as part of progress.

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THE PLANNED ENVIRONMENT: AN EDUCATIONAL TOOL

by Bertram Berenson, AIA

Research in architecture at this point in time seems to take two forms: one seeks to study the technology of building. This runs the gamut of both old and new methods for building buildings and applying to them either the visual or technical variables which form the pallet of the designer, the architect, the industrial engineer, and the planner. The second category, however, is a considerably more subtle one because it has to do with the vicissitudes of people, and this necessitates coming to grips with an infinite number of variables which fall outside the normal consideration of the practitioner simply because he has used, probably for centuries, a pseudo-psychotherapeutic technique in determining the real needs of this infinite number of people with their equal number of attitudes and predispositions toward their environment. The profession of environmental design is just beginning to give credence to the collection of hard behavioral data in the application of the design process to support human activity, and relationships between space and behavior. The ultimate three-dimensional consequences of the designer's intellectual and emotional effort on behalf of himself and society, in my estimation, has not been faced squarely because of his almost total dependence on a seventeenth century set of design criteria.

Whether or not Freud or MacLuhan said it, ultimately, the environment is a composite force in experience-gathering as well as a catalyst or reinforcement in human experience. This statement can be supported with the fact that the environment will shape human and societal value structures in various ways. This means, without question, that the new social and behavioral art and science of architecture is faced with the grave responsibility of imposing a visual overlay which structures a man-made environment which, in turn, tends to partially structure Man himself. This may be the expectation of the "new architecture".

Recently, the problem of relating environment to behavior has become a popular topic for conversation and some modest action. These relationships reveal themselves only in tiny fragments and thus humble effectively the Messianic tendency of the architect in this century to search vigorously throughout the human estate for information-gathering methodologies concerned with people and buildings and for the means of extrapolating logically this material into a meaningful and consistent three-dimensional world.

Because the immediate and critically germaine usefulness of architecture is often described in over-dramatic and jargon couched terms, the potential usefulness in impact and application of a strong visual and functional statement is rarely realized. As an example in education, for instance, we face the architectural prejudices of the non-architect-politician-administrator who demands that the architect look at the old aesthetic simultaneously with a distant future in the making of decisions about what he must do architecturally. The distant future of education in our society suggests increased mechanization through electronic systems of retrieval and distribution of information, but what sort of house will work for the student and his machine? And how do we link the individual or group, the teacher and the child, with all the resources, electronic and human, they will demand?

The total sequence of the educational events - those series of episodes in which learning takes place - is almost never systematized architectonically: they are not described in architectural terms but only in the teacher's scheme for teaching, and these are promptly relegated to a desk drawer for the eyes of the teacher, by the whims and fancies of educators, administrators, psychologists, politicians, and for that matter, the architects themselves. Put away for use only after a building exists, such educative process programs do not serve to shape the human environment for which they provide the raison d'etre. Yet, somehow they must. Research in education must be described as a function of the quality, the quantity, and the sequence of human efforts in the gathering of information; the evaluation of the design meaning of such information; and its application. In order to do this, multifaceted attacks will have to be waged on several levels: the ways in which normal children grow and learn as well as those who are intellectually and functionally handicapped - their education, the educational process itself, and concurrently the structured environment in which this process takes place.

Architecture and education, through an interdisciplinary research approach, will attempt to refine and define modes of communication of all the disciplines which may make architecture an integral part of the educational process and not just an adjunct to it. Interdisciplinary effort is obviously the key for any research undertaken in the uses of environment and it must address itself to the filtering, discovery and dissemination of pertinent data that might result in expertise for the theoretician, the innovator, and the user in all fields related to the problem. In order that the research methodology remain consistent with educational progress for the gathering of data as to the use of the learning space by the children and the teacher, the real needs can only be determined within the ongoing educational environment through a structured system of observation based on a theory of definitive measures which will provide the researcher with an accurate picture of those qualities by which the environment does indeed reinforce the educational process and perhaps those which actually become destructive elements to the growth and maturation of the child. Fragmentary data available from behavior modification research suggests that environment is one component of the operant conditioning process. This information suggests that through careful structuring of an environmental situation, a behavioral, response may be accurately hypothesized. The stimulus-response mechanism may take environmental cues in order to generate a reward. Media, then, may perform similarly which may open yet other possibilities for their use in active concert with environment rather than as addenda to it.

Consequently, it also remains to be seen where the so-called dependent and independent variables interact. Whether or not a child's learning rate changes in a direct relationship to the texture of a floor at the extreme cannot be described unless such things as motivation, diet, physiological comfort and other variables are also used as referents.

Educational research for environmental uses will justify identifying dependent and independent variables in a systematic way. It remains to be seen which ones can be identified as the most important and whether or not environment will change on account of them.

To gain access to a working laboratory of ongoing programs within existing buildings and to develop a comprehensive method for evaluating these programs and buildings in their interrelationships is the first stage of a research project presently underway. There exists in the educative process certain commonalities; and during the beginning phase of the work, these common occurrences should provide a working statement which will establish a priority list of the needs and goals applicable to all of the educational community. There is no way to divorce the student from the educational process, nor is there a way of circumventing the education of the teacher and the challenge or lack of it she brings to her classroom. Nor is it possible to view the educational process without making efforts to appraise the geographic and economic significance of education in a given region. Whether or not anyone or all of these factors can be described in architectural terms is still an unknown. It is assumed that a skeleton force of curious participants will allow analysis to take place and that from the analysis the essence of the change that has to do with program and design will be determined. None of the foregoing should indicate that the teacher and the children are not the two most important determinants in education nor for that matter to say that a good, dedicated teacher is not the best vehicle with which to support a sound relationship between children and education. That is only a beginning, and the end is not a question of human warmth fighting with the proper position of the blackboard, but how that teacher can be more effective through bringing the best possible educational resource within the grasp of each child.

Too frequently, architectural research in building types results in a series of prototypical solutions which are for all intents and purposes not protopypical: guide lines tend to become solutions and these solutions a series of rigid relationships described by square footages, door and window placements, scaled illumination levels, materials descriptions, all out of context. Architectural research, in actuality, should produce conceptual information that is generalized enough to provide starting points for design. It should discover the catalysts that stimulate the imagination of the designer within the framework of a given series of human problems, not simply descrive architectural standards which describe anonymous spaces for consumption and use by anonymous human beings. A guideline then, in the case of the exceptional child, for example, should describe the abnormality, his perceptual limits, information input potential, and these should open simultaneously a Pandora's box which would then suggest the subtleties and values of the environment as a type of supporting tool. Parenthetically, proper guidelines should describe further other human values: problems relating to the economic, social, cultural, geographic factors and perhaps some of the applied and theoretical principles which are concomitant to the eventual design solution. Considering the fact that very little meaningful environmental research has been forthcoming, it would seem also necessary for the designer to build into the three dimensional design process methods for the evaluation of the effectiveness of the environment he has designed after it has been in use.

It might be mentioned that there are a series of rather synthetic relationships that can be structured within the general framework of environment. They are synthetic in the sense that the spectrum of human enterprise in the behavioral sense may be intuitively recognized within a series of environmental constructs. This suggests that certain kinds of behavior modification may be catalyzed or generated or perhaps reinforced through the manipulation of the environment, and if it is the objective of the educator to make the most out of his educational envelope, then it should be recognized that the envelope may be doing things that either distracts from, or perhaps adds to, the potential of the teacher and the educational process. Would it not be possible, then, to equate the physical properties of the learning universe to the optimum configurations for information transmission and feedback which might be inherent in this learning space. This may be further broken down into formal and informal learning spaces where the exchange of ideas or for that matter the exchange of attitudes which may bring about change are seen in environmental terms. To learn independence, for instance, the child must be introduced on a graded scale from the simplest to the most difficult task, from something perhaps as obvious as his going and returning unchaperoned from classroom to toilet room, to the solution of complex problems in peer group management and the evolution of leadership among students and teachers. Distance, time, number concepts can be taught by the environment.

Some educators state that success breeds the need for more success, and that the solution of simple problems which do not stretch the frustration tolerance of the small child provides a better opportunity for both the qualitative and quantitative introduction of new ideas. Since the educational experience is both a social and an informational one and provides a stage for change it seems infinitely logical that such things as the reduction of anxiety, the increase in tolerance levels to change, ability to adapt, inherent promise to comfortably lead or follow and indeed to participate in a meaningful way in these experiences should be looked upon as having environmental or design implications. At this point it should also be suggested that the anonymous school, the one in which a series of small cubicles are placed in a larger one with no consideration given to individual group differences may have a detrimental effect on the learning and the child's ability or willingness to see the environment as more than a necessary adjunct to his life-space. Special spaces for special activities is an obvious result of this notion. There is no reason why a corridor need be only a space where large numbers of people gather once each hour or at the beginning or end of the day for short periods of time, It is a transition space, a place where exchange of information takes place. Since it is not economical in the educational sense, the hallway might be recast into a series of information centers, social cubicles, private work places - a multi-faceted resource device as one now assumes the traditional classroom is. There is no part of the learning environment that does not have the potential of serving a variety of needs.

The art of Architecture which remains on an intuitive level in the mind of the designer should then provide this intellectual resource for a careful and sensitive program evaluation of the activities which go on in the space. In the environmental sense there might be mentioned the potential effects of too much flexibility. Since the adaptive behavior of the child will vary, one wonders what elements of the school house configuration, both internal and external, should remain fixed. Is there a dependence on some elements in the learning environment that will always remain the same? This again brings up the question of the child identifying with a place in which certain activities go on. Can this be done when team teaching techniques pay no heed to that specific place with which a child may identify his territory? I am less than convinced that a constant manipulation of interior spaces provides the pivot point around which a child normally functions in school. His house necessarily includes a space in which one primary activity is carried on. This is not to say that team teaching does not intrinsically and extrinsically have great value; but should a child have his own place to which he always returns within this method?

The concept of the "new school" is frequently the maintenance of one space only insofar as mechanical requirements limit its manipulation. Is there not parenthetically a value in a subjectively unchanging environment in which new teaching techniques may be carried on? Perhaps the key word is subjective - something that the child learns to recognize as his own and something on which he can depend, perhaps the desk or a study cubicle may well be the first media persentation screen, but then again I believe that it must be something that the child can touch and therefore feel and intimately know. As I have mentioned before, the child learns through all senses, not just the visual and auditory ones.

When comprehensive resource centers become a reality and information retrieval becomes a continuing and substantive part of the learning sequence, some of the specific questions now asked in relationship to the limited use of readout devices will direct themselces to the significant problem of the Man-machine relationship. Although the work of Ken Isaacs was primarily one of design, his learning box in which all six inner surfaces of a space were used to produce information might give us some clue as to a complete physical relationship between man and an audio-visual learning experience. This box was able to produce information on all of its interior surfaces with parallel sound systems supporting the information displayed. For instance, the study of astronomy became more clearly apparent to the learner when he was actually standing in the space and relating himself to patterns and positions in the solar system in what might ve considered the four-dimensional sense. The machine then became a composite reality of synthesizing information producing devices. The Link trainer for pilot training has reached a very sophisticated point in environmental simulation. At what level of ability to comprehend and accept complex bits of information should a child reach before he is introduced into this complete simulation apparatus? How and in what ways will he require some ability to communicate with the "outside"? It is not too unreasonabbe to think of the classroom as this kind of learning box, as a satellite resource center in itself with mechanisms that not only create information through audio-visual and kinesthetic channels but also provide the opposite combination of potential uses in evaluating, on an ongoing basis, the learning behavior of the child and therefore the teacher or the boxes adequacy in producing information that is absorbed and understood.

It logically follows that the investigation of the channels through which children learn could become increasingly important. First, teaching methods tried by Maria Montessori early in this century pragmatically stipulated that children are able to organize information through a variety of sensory channels, but that these ideas include the uses of the senses of taste, touch and smell as often as those of vision and hearing. The total learning box should, in my estimation, make use of these five sensory channels with the reservation that the learning experience be limited to the child's ability to cope with one or more of these channels simultaneously and to make use of the information: this, of course, subject to evaluation techniques which one might almost automatically think of in terms of computers aids. How does the machine operate in these many dimensions and when can it tell if the respondent is unable to handle ideas in this multi-dimensional frame and how will the machine respond to a non-task oriented experience where evaluation remains relatively intuitive? This, of course, implies infinite human variables which should supply, at any given point in time, the proper response to the child's accomplishment. Of course, this need not be limited to children nor should it be. From by-products of a comprehensive series of experiences, it is understood that we continue to learn at varying rates throughout our lives.

The use of sensory channels is bi-polar. Deprivation will cause an hallucinatory response if one is deprived the use of these channels over a relatively short period of time. Studies of future space travellers bear this out in research on weightlessness. On the other hand, an overdose of sensory stimulation will cause almost the same kind of response in the gray areas between the poles which have not been carefully researched and will, of course, divert reference to all the human and environmental variables which may impose on it. This leaves the structuring of these channels, the ordering and sequence problems to be solved.

There are other sensory or environmental cues which will act as catalysts about which we know a small amount. For instance, studies in color with psychotic patients have shown that color alone may cause over-stimulation similar to hallucinatory drugs such as LSD. Environmental research is beginning to involve itself in the foreground and background cues which have to do with traditional design variables such as contrast and scale, and questions arise that have been asked for centuries: what is a big space, what is intimate space, what is small or large, what constitutes a barrier, is there an acceptable noise level for a given task, what has light level to do with work output, at what point does the acoustical character of a space relate to that which goes on inside of it? None of these questions is easy to state and considerably more difficult to answer. These ideas can be looked at in terms of educational variables also, because each one may have some influence on educational behavior which is the point at which one begins to describe media, information ideas, real and abstract, in terms of the environment. The question of the identification and organization of these variables is as infinitely complex as the potential resources for introducing information.

B.F. Skinner is synonymous with behavior modification. Part of this work requires a subject to produce a certain amount of work in order to receive a reward. As an architect, I cannot any longer believe that the environment is reward enough. At least, not in the way environment is presently constituted. This brings me to the question of what is a significant reward and whether or not the environment or some fragment of it may produce the generating influence to accomplish a task and when that task is accomplished, be influential in producing the reward. Most philosophers and some psychologists question Dr. Skinner's work in terms of its morality; that the action-reaction pattern is no longer the result of personal decision, but placed frequently in terms of survival alone. This may not necessarily be true, but on the other hand, one wonders if the intermediate stages which one must pass through in order to anticipate are not as important as the substance of the reward itself. In environmental terms, perhaps more so.

So much of this material suggests to me the question of what is really important in the first place and how we as human beings may establish a priority method to determine what must be done first to either prove or disprove these hypotheses. Hence, it is now old hat to think of environment as involving a single discipline although I fear that architecture, my overglamorized profession, sees itself as a combination of a Madonna and Leonardo. The real design involvement in producing the meaningful space is implicitly an interdisciplinary one. Without a direct line of communication to the behavioral and technological disciplines which include almost every major scientific and protoscientific resource, these questions will remain unanswered. Therein lies the second major problem which would not be critical if it were not for the fact that architecture is an art--the momentary flash of three dimensional insight, the application of aesthetic principles inherent in design solutions could allow for the substantive use of information acquired in the generating environments for human use.

Would it be premature or too restrictive for the architect-researcher-educator if he did not admit that the problem goes well beyond that of the single mass function envelope. Therefore, the further investigation of this problem of environment, behavior and learning must without question take in the larger construct of the environment whether it be the park, the neighborhood, the core city, ghetto, hospital, university, region. Saarinew, one of our greatest architects, aptly stated that a single building is but a pebble in a quiet pool which generates concentric rings, therefore relating to all the human and visual functions surrounding it. This point best portends the study of environment with special emphasis on educational and medical facilities and in turn the intrinsic learning and evaluation components they include.

The technical aspects of getting buildings designed and built must also be discussed because this society is no longer able to contemplate the construction economy and costs, materials and labor, will, in twenty years, disallow the sticks and stones disposition of our construction resources. Here again, education can lead - and for that matter, is already beginning - to see the usefullness of flexible prefabricated systems of construction. The SCSD organization in Palo Alto, although the schoolhouse construction at the present time is limited in application and perhaps too expensive, begins to look at the problem. Prefabricated systems do not mean a series of shoe boxes for which people must adapt if they are developed properly and should completely equate with the purposes for which the building is built.

In this country, the construction industry is twenty years behind Great Britain and the Soviet Union in the development of prefabricated systems, and those in Great Britain to my mind offer the functional and visual flexibility that must be inherent in a truly usable system of construction. The Educational Facilities Laboratories, among other organizations, is supporting research in construction systems especially designed for use in education. It would seem at this point that the designer must go beyond the system itself unless he considers the system as integral with information transmission. In this way, such prosaic terms to the architect, like inter-face, may be literally applied to the problem of building. It is conceivable that the Man-machine relationship may be looked at partially in terms of building systems, that the mechanisms no matter how sophisticated will produce kinds of information in the sequences desired by the educators and be "built into" the building itself. Considering the rate of deterioration of existing school facilities from the pre-school through the universities and the rapidly increasing number of students at all levels, it seems apparent that some credence must be given not only to what the building is and how it works, but also as to how it gets systematically designed and built.

Even though the configurations of geometry may vary greatly, the sites, the regions and therefore the climate and certainly the predisposition of designers and educators to the problem there must be discovered environmental, educational and machine commonalities which may be applied to this design and behavioral equation. Perhaps the place to begin is with these commonalties, but one must add that it is beyond the purview of the architect to adjust educational commonalities that may be turned into an easily replicated element in the educational configuration; and therefore, the educator and child must determine them.

None of these problems can be simply stated because they are not simple problems. They must however be attacked by the progenitors of environment. The designers continue to produce the little red schoolhouse with a few superficial twentieth century modifications. As previously stated, the answers to these questions will probably come from the educator, from the children and from politicians. The architect is a filter through whom invention will eventually take place, and he must then constructively apply each fragment in this design universe, but also continue to see these fragments individually and collectively. Without this orientation, I suggest that solutions will fall short of the desired goal. Environmental aids to education can be used inventively, wisely, and flexibly by those for whom we must provide them. But only if the realities of educational-technical-design and information resources available can be established.

KNOWLEDGE NEEDS IN EDUCATIONAL ADMINISTRATION AND TEACHER EDUCATION IN THE DECADES AHEAD

by Keith Goldhammer

Introduction

The assignment given to me involves two separate but related topics, either one of which could occupy the total time for this conference. To assure space for each, I have chosen to deal separately with each aspect and not to attempt to put them together into a common frame of reference. The problems of the future for both fields are so extensive that only major priorities can be discussed in the time provided.

As I reflect on this assignment, I am well aware that in spite of the continuing research on teaching and educational administration, both fields have moved ahead with "glacial speed" in response to the research. The reasons for this response are extensive and debatable, but I believe they can be explicated and an analysis of research needs in the future should take into consideration why the gulf between the current state of knowledge in education and educational practice has been broadened rather than reduced as more opportunities for research have been provided. At least two of these factors are pertinent to my subsequent discussion.

First, there continues to exist great barriers to communication between the researcher and the practitioner in education. The educational researcher is generally trained in an academic discipline, primarily psychology or, to a lesser extent, sociology. He speaks the abstract language of his discipline, and his research is theoretically oriented, using the conceptual apparatus of his discipline. His reports of his research are written for the appreciation and approval of his academic colleagues and are marked by a degree of scholarly sophistication that is not highly pertinent to the practitioner in the field.

On the other hand, the practitioner in the field is rarely trained to use the findings of research in his practice. His training is more likely to be oriented toward the methodological problems of instruction, classroom management, materials selection, budget-making, group processes, and so forth, rather than toward either understanding the language of theoretical research or drawing implications from it for the guidance of his professional interventions. To him, the language of the researcher is not only remote and inaccessible, but the research itself appears to be unrelated to his practical problems or of little consequence to the mundane professional decisions which he daily must make. The researcher and the practitioner live in two different worlds, and, seemingly, never the twain shall meet.

A second factor is probably the most critical one for the creation of this disparity between the researcher and the practitioner and the lag between knowledge and practice. The fact is that research in education has only infrequently been realistically related to practice. It is generally designed as basic research. Implications for educational practice are avoided, and researchers have a variety of defenses against having their work stand the test of validation in the arena of practice. The middle step between research and practice - namely, development - has been lacking. The development which normally takes place in education - namely, models of curriculum design, the staff utilization projects, and the new approaches to teaching methods and contents - are the implementations of subjective evaluations of educational practices, involving eclectic recommendations for improvement and evangelical efforts for diffusion. Development in education, where the goals are ambiguous and the processes of education diffuse rather than specific, has never been clearly explicated as a part of the research function. It is likely that until this happens, there will continue to exist a fundamental lack of congruence between existing knowledge and practice in education.

Knowledge Needs in Educational Administration

The field of educational administration is relatively new. It emerged in the latter part of the 19th century in this country, and it was defined as a special field of study during the early decades of the 20th century. Its content has never been clearly delineated, in spite of a proliferation of college courses, and its practices in the field have emerged in response to social exigencies rather than from a commonly accepted theoretical base or a specific body of information which delineated the application of specific strategies for the achievement of desired consequences.

Since 1950, as a result of the Cooperative Program in Educational Administration, financed by the W.K. Kellogg Foundation, there has been considerable emphasis upon the study of administration, the development of coherent theories of educational administration, and the encouragement of scholors in other disciplines to study the phenomena and problems associated with administration, but changes in the practice of the field, it appears to this writer, have come about more in response to social pressures than because of the applications of existent research.

The field is currently divided between those who hold that the role of the administrator is that of the manager of an extensive educational bureaucracy and those who maintain that he should be an educational leader, or social engineer, who guides the adaptation of the educational enterprise in accordance with social requirements and technological advances in the field. There are, of course, many "in-between" positions. Fundamentally, however, the field is confused and divided, and the young administrator lacks the guidance he needs for a clear and positive delineation of his administrative stance. As the executive head of an educational instutution, he cannot avoid the social pressures for change of his role. Nor, as a socialized professional educator, can he completely relieve himself of the commitments to the inherited dicta of the educational establishment.

Clearly, the role is the center of tensions as external pressures demand change and internal commitments place a premium on the maintenance of traditional roles and performance styles. In spite of this conflict, there are some indications of the types of pressures that will be placed upon the educational institution of the future and the kinds of problems with which the school administrator will have to deal.

Probably, the most fundamental change in the educational enterprise in recent years has been the expectation that education must play a dynamic role in the solution of pressing social problems and the implementation of national policy relative to these problems. This is not an entirely new requirement. Franklin's Academy was a response to social exigencies, and the role of public education in the acculturation of the mass of immigrants during the 19th centrry was a manifestation of the American expectations for its schools. But the emergence into awareness that national as well as local issues must be resolved through public educational institutions and that major educational strategies must be developed to cope with these new problems is a matter of prime concern today and will continue to be in the future. The continuing problems of minority segregation, of education of the culturally and economically impoverished, of the provision of educational programs for the physically, psychologically, and socially and culturally atypical children are pressing upon educational administrators with renewed vigor; and these problems are likely to become more intense in the decade ahead.

The school administrator today, and in the years ahead, has to become adept in dealing with the diverse normative structures which are contending within the local community as well as within the national life. The school administrator has become expert in dealing with a fixed local power structure. Evidence shows that he relates himself and his school policies to an influence structure representative of the middle class of American society, but he appears to be at a loss to know how to deal effectively with diverse groups as they contend for power. Even more significantly, he seems to have difficulty adapting educational programs and processes to the motivations, aspirations, and requirements of groups within society which are not impelled by the values and aspirations of the middle-class ethic.

The school administrator has been taught how to perform the paternalistic role of the chief executive in an hierarchical, bureaucratic organization, but he is finding it difficult to make the adaptations in his perceptions of his roles or the development of appropriate administrative strategies now that he is faced with a revolt against administrative paternalism and must contend with demands for involvement in decision-making by groups which formerly have been effectively separated from governmental processes. Not only with contending minority groups in the community, which have now become vocal, but with parents, teachers and students in the schools, the administrator now faces situations of conflict and competing goals and perspectives.

The basic patterns of school administration were devised to meet the needs of a rural, and primarily agrarian, society. Society, today, is highly urbanized and the trend is likely to continue. Today's administrator does not deal with a simplistic community. His community is complex, heterogeneous, cumbersome, and diverse. His relationships with forces which impinge upon him may be remote and formal, and the values which dominate local gooups who make demands upon the school may be imposed through national affiliations rather than arising indigenously within the community. For the most part, he has to deal with paid functionaries who have limited authority to compromise and whose careers depend upon their ability to effect their groups' demands with as little variation as possible.

The school administrator has been prepared to operate an educational institution which enjoys a privileged position in the political arena of society. The American tradition of local educational control by an *ad hoc* governmental unit helped to remove education from much of the rugged competition which characterized the political life of the community and nation. With the advent of education as a major instrument for effecting national policies, and with the extensive increase in the needs for additional revenues and resources, the schools will increasingly be thrown into the center of political competition and strife. On all governmental levels, both the policies of education and the revenue needs of public schools are controversial issues. To maintain stability of educational purposes, to chart a systematic course freed from the erratic demands of pressure groups, to obtain the revenues essential for maintaining the enterprise, the school administrator finds himself a political figure, subject to attack by his opponents and having to defend the needs of the schools in competition with other institutions which also have expanded beyond their traditional bounds.

Along with all of these pressures for role adaptation, the administrator also must face up to the fact that the technology of both education and administration is undergoing rapid change. Schools cannot continue as usual. Content changes are essential, and the methodologies of instruction are in need of up-dating in order to utilize technological inventions appropriately to assure continued effectiveness and economy. Technology also affects administrative processes, and the administrator today finds need to understand the applications of computers and data processing systems to the problems of administration and the routines which enable him to achieve better performance of housekeeping functions and information gathering processes.

The impostions are overwhelming, and the informational needs of the field fairly staggering. I shall discuss some priorities for research and development under four headings: the social milieu, the institutional milieu, the job, and the agent.

The Social Milieu

The schools exist in society because they have something to offer to the broader society. They will continue to exist only to the extent that they can contribute meaningfully to that society. Today, the schools are in somewhat of a clash with the educational needs of the broader social milieu. This clash results from the fact that professional bureaucratic organizations, once they have achieved an equilibrium in thiir operational patterns and programs, attempt to maintain that homeostatic state and resist modifications which upset the equilibrium. The administrator is the agency which society expects to achieve congruence between the social demands for change and the equilibrium of maintenance needs of the institution over which he is executive. Most of the problems of the administrator in relation to his social milieu stem from this dilemma.

This problem is well observed in the major structural problem facing the administrator of the future. Local control over education has been a prized characteristic of the governance of schools. It is a primary tenet of school boards and administrators associations. One is almost suspect of subversion if he dares to challenge its desirability. Yet, local control has not resulted in the necessary adaptability of educational programs to meet the needs either of the broader society or of the local community. Without federal and state interventions and subventions, the schools could not continue to operate or provide as much adaptability as they evidence. The school's role in relieving local and national problems can be performed only as it can operate over the restrictive impositions of the local community. Structurally a new balance in educational governance has to be established between local, state and federal levels of control. The model for achieving this balance has not yet been established. A major requirement for the improvement of the organization of education is that (1) studies be made of various types of arrangements through which levels of government can share responsibilities for educational governance and (2) the consequences upon the educational function of various structural relationships be determined.

A second related broad area of concern lies in the expectation that schools will increasingly become major instruments in the effecting of national policies. Since the Supreme Court decision on the desegregation of the public schools in 1954, the schools have been caught in the conflict between the broad definition of national policy and local factors which are either indifferent or hostile to the definition of the national interest as currently politically determined. The superintendent of schools may well find himself and his board caught in the dilemma of having to abide by court orders which citizens of the local community dare him to enforce. He may be in sympathy with the educational objectives of the court orders or the national programs to which his district is asked to prescribe, but to retain his position or to maintain stability within the school system, he may have to defer to local antagonistic interests. He is sometimes hard pressed to find the educational justifications for the interventions he is asked to make to resolve social problems on the local level, but without this information, he cannot justify his district's participation. It is essential that he have information which is readily available and which will help him determine the consequences upon the community and upon the education of children of the programs which are externally financed, but which must be locally administered.

A third major informational need relates to the establishment of working relationships with the diverse groups within the community with which he must deal, whose children must be educated within the local schools, but whose normative structures are not congruent with those of the dominant culture of the community or the schools. Relatively little information is available to him about the diverse value structures of modern society, how they operate within the arena of community affairs, and how they relate to educational policies, educational goals, and factors related to both the motivations of children and the curriculums which might meet their needs. If the schools are really to serve the needs of all of the children of all of the people in our society, it is imperative that administrators have current information about demographic and value differences which will enable them to give leadership to professional colleagues in the endeavor to make educational programs relevant to the needs and aspirations of all groups within society.

A fourth factor is closely related. In developing educational policies and in formulating approaches to maintain acceptance of the schools' programs and recognition of its resource needs, the superintendent needs to know how to communicate with these diverse groups and how to maintain stability of organizational effort in spite of the diverse demands of the various groups which impose pressures and constraints upon the schools. As previously indicated, not all of these groups are locally controlled, and many are reflections on the local level of national programs and national political aims. To work with these groups, the administrator needs to know a great deal about them, their major program objectives, their clientele, their methods of operation, the consequences of their programs upon society and upon the educational function in society, the sources of their funds, and their ties with other groups.

A fifth major concern, frequently expressed by school administrators, is that national crises are upon them before they have any strong indications of arrival. Few if any research endeavors have been made to forecast the implications of current trends for future social and educational programs. Superintendents need projections of trends into the future with implications of these projections for program adjustments. Probably no other information system than one which maintains current analysis of major social trends as projected into the future would be so beneficial in maintaining both the adaptability of the schools to social needs and the maintenance of organizational stability during periods when rapid adjustment of programs is essential.

A sixth major concern of administrators lies in their responsibility for maintaining the schools as adaptable to the occupational and manpower needs of society. Increasingly, public education must become occupationally oriented. A major function of the schools for the children of economically disenfranchised groups will be to help them perceive a useful, remunerative future for themselves. General vocational preparation may need to begin as early as the child starts to perceive a discrepancy between the opportunities seemingly available to him and the legitimated aims of society, and even for economically fortunate groups, greater emphasis upon practical realities of the child in relationship to his future may be necessary. Vocational programming in schools has been slow to develop and not responsive to the changing occupational structure of society. Considering the rapid changes which are taking place in the occupational structure of society, the administrator has to develop programs which look forward ten to twenty years. How the schools prepare children for the changing world of the future presents a considerable dilemma. An adequate information system projecting occupational trends into the future is essential for the maintenance of a viable school curriculum.

The Institutional Milieu

Within the educational organization itself, major changes are pending and the administrator needs information in order to cope with them. As previously indicated, one of the most significant factors affecting educational administration today is the movement against parternalism in the governance of the school organization. All the organizational models which have been adapted to educational institutions are paternalistic in nature. They are adapted from hierarchical church organizations, industry, or the military. Congruence of these models with the imperatives of an educational organization has never been achieved. As a result, the major commitments of administrators may be directed more toward organizational maintenance than to the achievement of educational objectives. The concepts of economy of operations and efficiency of performance, for example, may have implications which impair rather then facilitate the accomplishment of program objectives. Organizational models designed to the achievement of educational objectives are needed. These models need to be tested, their consequences upon education determined, their impact upon the ability of society to tolerate them and to support them needs to be analyzed.

School administrative units are becoming larger in response to the urbanization of society and the rapidity of transportation and communication. With computerized information systems now available as administrative devices, the probability for maintaining decentralization of certain operations within and compatible to the centralized school unit is enhanced. Many of the deficiencies of the largest school units in the country stem from the inability to establish the proper balance between centralization of services, financing, and supply while decentralizing authority for the professional decisions which must be made. The problems of achieving compatibility of centralization and local attendance unit autonomy in certain phases of operations are complex. Research is needed to experiment with different structures of relationships in order to find the impact of different patterns, thus enabling school officials to select a pattern which is most useful for the accomplishment of their objectives.

Probably no factor is more time-consuming to the administrator of a school district today than that of procuring the resources which are needed for the maintenance and improvement of the schools. The problems of educational financing will be dealt with in another paper and will not concern us here. However, a part of the problem arises from suspicions that tax dollars are not judiciously allocated to major functions within the school organization nor is the tax dollar used within the schools so as to maximize educational advantages. Cost-quality studies are difficult to make, even in operations where the goals are ambiguous and it is impossible, or at least extremely difficult, to define the end product desired. Nevertheless, administrators cannot remain oblivious of cost-quality relationships within the school organization, and major effort is needed to develop instruments and techniques for measurement, to establish criteria, and to define satisfactory levels of performance.

Similarly, information is not readily available to the administrator relative to the most effective types of organization for various kinds of instructional activities. The range of possibilities for group instructional organization has been extended in recent years, but information is lacking upon the effects of various structures for particular types of learning tasks. There is some evidence that judicious utilization of existing recommendations is sometimes lacking. Information is needed on the most effective uses of large and small group instruction, team teaching, individualized instruction, non-grading, multiple class grading, and so forth.

In the larger school units, quality controls are essential to insure the viability of the organization in relation to its performance goals. Yet, not enough is known in education about the best techniques for the supervision of teachers or the criteria which should be used in the evaluation of teaching. Some interesting developments have been made in recent years, but more is vitally needed to bolster administrative control over the quality of performance with the schools.

Problems which arise out of the sheer cost of instructional personnel will dictate some major shifts in the utilization of professional personnel within the school organization. In the years ahead, it can be expected that professionally trained and competent teachers will become even scarcer than at present, and gradations in professional status based upon factors of preparation and competence may be necessary. It is also possible that we will require broader use of interne teachers, teachers' aides, material specialists, among other devices for extending instructional effectiveness within the schools. Studies are needed of patterns of staff utilization in relation to specific types of instructional activities as well as under specific kinds of professional availability problems.

The Job

Although much is known about the problems of human relations and management techniques in organizations, relatively few experiments or studies have been conducted in educational environments. More are needed. The job of school administrators, on various levels, involve both dealing with human beings, attempting to help other human beings maximize their effectiveness within the schools, and allocating and directing the efforts of human beings toward the accomplishment of the major objectives of the schools. With the probabilities for continued shortages of both manpower and money, the effective utilization of the human resources within the school organization is a concern of major magnitude.

Major concern must also be expressed for the definition of the role of the educational administrator. Is he more a manager or a leader? Is he more effective in dealing with housekeeping chores than organizing the staff for educational decisions? Is he a service agent to the teachers, or does he represent the public interest in effecting program maintenance and change? Although some operational role definitions are common in the profession, there are many questions and much debate relative to the proper roles that are to be performed. In many instances, conflicts in roles and role expectations exist because of failure both to define appropriate roles and to test the effectiveness of the administrator in relation to the roles he can effectively perform. Information is needed relative to the impact of different administrative role definitions upon the schools, upon the maintenance of staff effectiveness, upon the ability of the schools to relate effectively to the community and to achieve their educational goals.

Administrative roles and techniques are particularly subject to change today because of the impact of technological inventions upon the management process. If he can use it, more information about organizational operations and pupil achievement can be made available to the administrator than was ever before possible. Otherwise onerous duties, such as the complexities of scheduling, the elimination of program conflicts, both cost and pupil accounting, the analysis of test scores, grades, and so forth, can now be performed by machine operations. But not in all cases is the technology of computer applications to administration well established, nor is what has been established always entirely realistic in relationship to the human needs of educational organizations. More information about the adaptations of machine technology to administrative problems is needed, but even more information is constantly required in evaluation of the uses of machine technology and its impact upon the total effectiveness of relationships within the schools.

It must also be noted that the impact of technology upon the job of the educational administrator also releases some of him time for involvement in other activities than those routine chores which no usurp so much of his effort. The greater adequacy of information which is available to him and the time freed from routine chores also necessitate some re-orientation of his role and his allocations of his time. This will not take place, however, unless the administrator learns effectively how to use the machine technology and the data which are now available to him and which formerly he lacked. In effect, the machine now frees him to become a more effective leader providing that he has the added information about society and about educational technology that will enable him to give competent professional leadership to his staff.

One of the administrator's major requirements now is that of obtaining effective evaluations of various educational strategies, their most appropriate use for different clientele of the schools, and the instruments of group process through which staff resources and intelligence can most adequately be mobilized for improvement of the educational program. One major implication of technological aids to administration is that the administrator, at least on the level of the principalship, will have both time and greater incentive for maintaining adequate evaluations of the school program. He will be hampered in his efforts to make adequate evaluations, however, by virtue of the fact that the evaluation process as related to educational programs is still underdeveloped. Additional instruments, criteria, and techniques for the evaluation of education are essential for local administrators to develop programs which attempt to maintain constant appraisal of all school operations with a view toward assessing the strengths and weaknesses of the schools and achieving a maximum adaptability to the needs of children and society.

Of particular significance at the present time is the need for the administrator to have both techniques and criteria for the evaluations of new products related to educational technology. A mass of new products are now available to education, and claims and counterclaims as to their effectiveness are made. Relatively few schools in the country can maintain product evaluation facilities. The end result is that the local administrator is to a considerable degree dependent upon the salesmen and their effectiveness in selling their own product, frequently to the detriment of the most effective and economical use of limited school funds. Information is needed both on products that are available and techniques that can be employed most adequately to evaluate the claims made for various types of products.

The Agent

In recent years much has been written about the characteristics of effective administrators, but there has been little, if any, valid research on the topic. The exhortative articles make demands for an administrator who has impossible characteristics to find among the general practitioners. Yet, one of the critical issues confronting education today is the selection of administrators who are competent to perform the necessary administrative functions for the schools. Most endeavors to determine the characteristics of effective and ineffective administrators have met with but little success. A current study of some magnitude has suggested that possibly for an organization such as the schools, it is impossible to define the characteristics of effective and ineffective administrators. However, the urgency of improving the quality of educational leadership in the schools and of selecting individuals for administrative positions who are most suited to carry out the essential functions requires that constant explorations be made to determine criteria for the selection of administrators who can meet the needs of contemporary schools. Training programs today make little effort to be selective primarily because of the difficulty in establishing criteria for effectiveness. Similarly, school boards and other school officials have little objective evidence as the basis upon which they can evaluate performance of administrators once they are in the field. It is undoubtedly true that for political reasons, many individuals who cannot perform the job effectively become employed and many of them, again for political reasons, advance to positions of top leadership where they cannot provide the effectiveness of functions which the schools require. Information relative to factors related to both personal characteristics and other factors associated with the effectiveness of the administrator on his job would help greatly to improve the selective and evaluative processes and, hopefully, the quality of administration available to the schools.

There is also some indication today that one of the most serious impediments to the adaptability of the schools to the changing requirements of our society is the failure of administrative leadership to provide the stimulus for change. Relatively few programs for in-service education of administrators are provided throughout the country and these are done without real knowledge of the techniques through which administrators who have long engaged in their profession can be induced to change both their perspectives relative to educational functions and their behaviors as administrators. Although some cues are provided through the field of social psychology, these cues have not been adequately tested with educational administrators, nor have the results of in-service education programs been adequately evaluated. Much more information is needed to determine the means through which educational agencies can help to upgrade the quality of administrators on the job, keep them constantly alerted to changes in the field, and assist them to modify their practices in light of newly established knowledge in the field of education.

There are several other factors associated with the nature of the incumbent in the educational administrative position that need to be explored. Not a great deal is known about the incentives that have impelled individuals along their career lines. A great deal needs to be known about these incentives and how they act as selective factors in screening candidates for administrative positions and the impact they have both upon the personality and administrative style of the school executive.

There are also some indications that major personality changes take place in administrators as they pursue their administrative careers. The old time administrator has frequently become highly paternalistic and assumes a proprietary perspective toward the schools which he administers. Whether psychological changes actually take place or are manifestations of personality traits that are present within the individual prior to his assumption of administrative posts is not known. However, with changes in the culture related to educational organizations, much more needs to be known about the impact of the job upon the individual and what initial characteristics of the administrator tend to become exaggerated as a result of his performance of the administrative role. The analysis of problems of this sort, too, should be of value in the better screening of candidates for administrative positions.

Knowledge Needed in Teacher Education

Alternately defended and damned, the field of teacher education has been the subject of considerable controversy during the past decade. As long as doubts relative to the effectiveness of educational programs persist, controversy about teacher education will also persist. Out of this controversy, however, there has come a considerable amount of agitation for reform and experimentation with the basic patterns of teacher education. Some of this experimentation gives high hopes for major breakthroughs in establishing better patterns than now persist. With the advance of federal subventions for the education of inexperienced teachers and the re-education of experienced teachers, some indications of future trends can possibly be made.

It is most likely that in the future a considerable emphasis will be placed upon the internship as a fundamental part of the teacher preparation experience and as an extension of the traditional forms of cadet or practice teaching. This trend, too, is evidence that in the future the teacher education program will be extended into the fifth year, and gradually, all but the pre-professional phases of the teacher education program will be eliminated from the undergraduate program. One can expect in the future most of the technical aspects of teacher education to be accomplished through activities associated with the internship experience. Thus, the undergraduate program will be reserved for general education, specialization within some academic field, and pre-professional preparation.

The definition of the teacher's total responsibility necessitates a broader look at the undergraduate program to determine what areas of pre-professional training should be incorporated with the undergraduate program.

A close review of the teacher's responsibility would indicate that there are at least four areas of pre-professional training that are essential for adequacy of preparation as a teacher:

1) Since the basic concern of the educational effort is the development of the child, every teacher needs to understand the psychological, physical, and social development of the child and the inherent developmental needs associated with each stage of his maturation. This will require greater emphasis upon both the study of child growth and development and both general and educational psychology as preliminary to the professional training of the teacher.

2) It is also apparent that the child lives within the context of a particular culture and a particular community. His education has relevance to the extent that it helps him to determine his roles within the culture and the community in which he lives. Probably one of the most severe weaknesses of current programs of teacher education is a failure to include adequate studies of American culture, the ideals of western civilization, and the sociology of the community as related to the educational enterprise. All of these factors plus some emphasis upon

the historical and philosophical foundations of education are essential for a complete understanding of both the child as a part of society and the educational function as a factor in the improvement of the child's ability to cope with the society of which he is a part.

3) Since a fundamental aspect of the educational enterprise regardless of its other emphases is the transmission of knowledge, a significant part of the pre-professional education of teachers needs to be a broad background of general education. It is not sufficient for the teacher to have a field of academic specialization. His job as a teacher, regardless of the level on which he teaches requires that he have sufficient knowledge of all fields of academic endeavor to know the basic language employed in such fields, the types of problems with which they deal, and something about career potentials in all of these fields.

4) And finally, since the teacher must work particularly in a apecialized area of the curriculum, increasingly so even on the elementary school level, it is important that he have a specialized preparation in one particular academic discipline. Although the school is much more than a purveyor of information to children, the acquisition of knowledge is one of the primary reasons for the child's being in school. With the explosion of knowledge in recent years, much more emphasis must be placed upon the adequacy of academic preparation among teachers, and the employment of teaching personnel within schools with varied backgounds of specialization in order to obtain a breadth of intellectual resources necessary for the range of learning problems which may arise.

I can see no reason why this framework will not remain the basic pattern undergirding teaching and teacher education in the future, but there are some particular trends which suggest some modifications in traditional patterns of classroom organization and procedures which need special attention. My suspicion is that these modifications call less for additional research than for the development of teaching strategies which arise out of existing research. They must also become basic to the professional level of preparation for teachers.

First, it is apparent that the traditional role of the teacher within the classroom may be greatly modified. With the advent of modern technology, the growing need for knowledge specialization and the continued concern for specialized pupil service functions within the school, there is a need for a team effort in the education of the child rather than an individual teacher responsibility. It is very likely that the teacher will become the instructional leader of a team of specialists and para-professional personnel, all of whom will be assigned specific roles within the instructional program. A great deal more emphasis will be placed on individual rather than group scheduling, and the child will come in contact with a number of adults who will be specially skilled in directing specific types of activities. The child will have opportunities during the day for individualized study either with or without the assistance of an aide, participation in both small and large group activities, and some time for drill activities in which he may be engaged in various sized groups or working independently with electronic devices. Just as it can be anticipated that time scheduling will be on an independent basis, so, too, will the educational program of the child be highly individualized providing that we learn how to utilize effectively the information systems which are available and which can constantly feed out data relative to the achievement levels and further educational needs of the child.

The person developing the master schedule for each child will undoubtedly be the master teacher, who will, in general, supervise the instructional activities of several other persons whose activities the teacher will be responsible for coordinating. No one has, as yet, worked out the basic instructional systems through which this specialization of the teaching process will take place. A plan, however, somewhat resembling the one I have suggested is essential in order most effectively to utilize the scarce professional competencies available. The employment of para-professionals is desirable to assume partial responsibility for the specific kinds of instructional activities which consume a considerable amount of professional time, but the complexity of which scarcely warrants the allocation of professional time to them.

Second, in addition to the effective utilization of the teacher's time and the establishment of new roles to maximize his professional effectiveness, an opportunity will be provided for the teacher to make more effective utilization of research on both teaching and learning. Having more time to plan and develop strategies of teaching, freed from the minute observation and control over children, the teacher should have time to utilize better existing knowledge about learning and teaching in order to apply that knowledge to the specific needs of the children who are his responsibility. Better information relative to how this application of existent research can be applied is essential.

Third, associated with this requirement is also the need to develop better strategies of content utilization than now exist. Grade placement of content--or even achievement levels of content--are currently derived from tradition or as a result of electic choices of educators. Strategies of content use on an individualized basis to promote specific educational objectives or to resolve particular learning problems of the individual child have not been adequately developed. Effective educational methods involve not only the use of knowledge about teaching and learning processes, but equally the most strategic employment of content in relation to the specific objectives which should be achieved.

Fourth, available to both the teacher and to the school administrator will be data systems which enable them to develop the most effective educational strategies both for individual children and for large groups of children. Not only will the teacher of tomorrow have more data available about children, but he will also find it necessary to utilize that data in developing both the individual schedules for children and the teaching strategies for various groups. A major problem for the teacher and the administrator will be that of working out the means through which teachers are helped to learn through their preparatory programs how to emply these data effectively, both in the diagnosis of pupil needs and in the provision of instructional experiences which will be most appropriate for the child's advancing to his next steps of educational development.

Fifth, it is also apparent that there will be an increasing number of technological devices developed to assist teachers in the variety of instructional activities designed to promote the educational growth of the child. Some of these devices will be most appropriately used in either small or large groups, but others will be uniquely adaptable to the independent or individualized use of a single child. Teachers will be able to use these devices effectively to the extent that they have received preparation for the most appropriate use of these devices for specific learning needs and situations.

Sixth, it can be predicted that a greater variety of approaches to various kinds of pupil groupings will enable children to utilize their time most effectively and will also enable the professional time of teachers and their assistants to be used most effectively for the accomplishments of the objectives of the schools. Considerable skill is needed by teachers to determine the best utilization of individualized instruction as well as the best means for utilizing the strategies of both small and large group instruction. To a considerable extent, the effectiveness of the educational program will depend upon the specialized knowledge of what types of organization best suit the purposes of a child with particular kinds of characteristics for the accomplishment of specific types of instructional objectives. Just as the physician must determine the prescription, when alternatives are available, which best suits the individual needs of the patient, so the teacher will have to determine the types of activities that are best suited to a particular group of children and the accomplishment of a particular set of objectives. A great deal more knowledge than now exists is needed relatively to the best utilization of all these patterns of pupil grouping.

Seventh, associated with all of these needs is the critical problem of the maximization of the methodological effectiveness of the various structural arrangements for teaching which can be employed. A current problem in education lies in the fact that teaching strategies generally vary but slightly for either large or small group instruction. It is difficult to ascertain, for example, the relative advantages of either small or large classes when we have not developed the techniques which maximize the advantages of either. The time has come when claims for superiority of teaching effectiveness must be supported by evidence which has been systematically collected. Without this evidence, the content of teacher education programs cannot be appropriately devised, nor will teachers be prepared to utilize the best techniques for the structures within which they will work.

Eighth, it must also be recognized that a great deal of research and development must be directed toward the analysis of the entire curriculum. Basically, the modern curriculum and graduation requirements are established by tradition, using models derived for college preparation out of bygone ages. The traditional academic subjects dominate the curriculum, and they apparently do not provide either the orientation to the needs of vast numbers of children nor the motivations to encourage their objectives for remaining in school and building constructive life goals. Until we have a curriculum that is meaningful to children with respect to their developmental needs and which builds their understanding of their abilities both to cope with the world and find their place within it, the school experience is likely to be "unreal," "imposed," and "unrelated." Fundamental curriculum change is a vital necessity and an essential factor in the preparation of teachers who can deal effectively with the problems of modern youth.

Finally, it is imperative that the teacher recognize the multiple types of atypicality which exist among pupils and be prepared to provide effective instructional programs for all pupils regardless of their range and variety of instructional needs. This applies not only to children with physical and psychological handicaps but also to children who come from a variety of subcultural settings and whose levels of values, aspirations, and motivations are significantly different from those typically middle class youngsters with whom teachers are traditionally accustomed to deal. Much more knowledge is needed and must be incorporated within the instructional programs for teacher trainees to enable them to deal with all children on the basis of their own individual problems and the socio-cultural phenomena associated with their living conditions.

Two significant implications can be derived from these reflections. First, it is apparent that in the future we must think in terms of a diversification of roles involved in the classroom learning situation with emphasis upon greater specialization for the performance of particular segments of the instructional responsibilities of the schools. This means that we will have to develop within the teacher education institution programs for the training of individuals with different types of competencies for different levels of professional service. We will have those who assume the roles of master teachers and leaders of the instructional teams who will be fully professionally trained for such service. There will be specialists who are fully professionally trained but for a rather narrow specialization. There will be paraprofessionals who will be trained to perform services under the guidance, direction, and prescription of the professional person to whom they are responsible, and there will be auxiliary instructional personnel who are less well trained who do not have the power of independent decision making and who participate in the guidance of children's learning activities with respect to relatively routine or mechanical chores.

It is also apparent that a system such as we herein suggest will require continuous research on many fronts and extensively maintained development programs in order constantly to apply new knowledge to the improvement of educational programs. On the one hand, this means a much greater emphasis upon research and development in teacher education than is currently the case. And, secondly, it means that the teaching corps will have to be engaged in continuing education programs in order constantly to bring their teaching competencies up to date and in congruence with the existing state of knowledge.

In Conclusion

The future presents multiple challenges both to administrators and to teachers. Education has become a vital national resource, both for the alleviation of critical social problems and for the maintenance of the human resources essential for the operation and defense of our complex social world. The ability of the educational profession to adapt programs, processes, and techniques to both anticipated and unanticipated social and individual needs is the challenge of the day. Research and development, particularly the latter, are essential for the accomplishment of that adaptability. New administrative and instructional roles are imperative, and these roles must provide for the transmission and diffusion of new knowledge and techniques to the operating personnel in the schools. As never before, complacency, indifference, or the defense of the status quo have dangerous implications for society's health and its desire or even ability to maintain the educational enterprise. The vital flow of new knowledge, new techniques, new strategies, new understandings is the life blood of the school in its ability to meet its new challenges.

TEACHER EDUCATION - THE CONTROLLERS OF THE PROCESS

by Harold Abel

The title of this paper implies in part that, regardless of the sophistication gained in educational information systems during the next two decades, in the last analysis it will be the teacher who must assume final responsibility for implementing the teaching-learning process. The title suggests also that the teacher's effectiveness will be determined, to a large degree, by the preparation provided him by the teacher education program.

We will examine these assumptions and their implications for the future of education shortly. But in order to gain perspective, let us pause for a moment to look back briefly before we move ahead. We can then proceed to examine the present status of the teacher and teacher-education, and finally we can look at the next two decades; both in terms of what is likely to happen unless there is massive intervention in the present educational process and also what should and could occur if public school education is to meet its responsibilities.

Historical Perspective

Status

As the world emerged from the depression of the 1930's the status of the American teacher was high indeed. He had had relatively secure employment and, in terms of income, he placed ahead of lawyers, engineers and blue collar workers. He was an "educated person" in a relatively uneducated society.

Although the handwriting was on the wall, it was not until after World War II and the higher education boom that the teacher's status in society began to slip noticeably. Millions of veterans were equalling or exceeding the educational level of the teacher. Furthermore, the results of pyramiding technological advances,nurtured by the demands of the war effort, were being incorporated into the curricula of colleges and universities. A myriad of new professions and subdivisions of traditional professions was born. The demand for theoretical and applied scientists in higher education, industry and government left the public school teacher - both elementary and secondary - standing at the post. And he knew it! In one swift decade - 1940 to 1950 - the staid, respected profession of public school teaching had suffered a drastic decline in both prestige and economic status. The inability of public education to embrace and became part of the technological revolution changed the teacher from one who knew to one who did not know.

The influence of the emerging glamour professions, the dependence of public education upon local taxes, the exploding demands of industry and government and the competing needs for personnel in higher education certainly were major factors in the prestige loss of the public school teacher. It is particularly paradoxical, nonetheless, that this turn of events occurred in the face of a post-war population boom which created a heretofore unprecedented shortage of public school teachers.

Preparation

The teacher education program of twenty years ago was essentially similar to that of today. (This is one of the problems we must deal with during this conference.) The prospective teacher was rather carelessly selected on vague criteria that paid lip service to such things as "being well adjusted and outgoing", "enjoying working with people", "liking children", and "being of high moral character". Valid performance criteria on these dimensions were almost totally lacking. Consequently, only the most obviously deficient misfits were screened out. Moreover, because of the growing need for teachers, the comparatively limited economic rewards and the generally less demanding curriculum in teacher education - especially on the elementary level - public education began to acquire more than its share of emotionally and intellectually borderline teachers.

Elementary education, plagued for decades (or was it blessed) by a shortage of men, began to see a slight increase in males entering the profession. But the desire of these men to teach young children is debatable. At least one alternate hypothesis is that they saw elementary education as a quick route to an administrative post with its greater economic advantages. History and human nature support this view. Most men in elementary education have moved quickly out of the classroom. It takes a dedicated man, with an equally dedicated wife, to continue teaching young children at increments of $300 per year while his friends and colleagues move ahead by leaps and bounds.

Although the typical curriculum in teacher education has had many variations over the years, its components have remained essentially the same. By way of example, in the preparation of elementary school teachers the course of study has usually required about two years of broad background in liberal arts followed or paralleled by introductory education courses such as "The American School", "History of Education", "Philosophies of Education", "Programs for Elementary School", and so on. There was usually one - at most two - courses in educational psychology and learning, sometimes involving observing and evaluating children in several activities, sometimes not. The balance of the curriculum was generally concerned with "methods" courses and practice teaching. One can cite method courses _ad nauseum_, but a few examples will suffice: "Methods of Teaching Reading", "Methods of Teaching Social Studies", "Methods of Teaching Science", "Language Arts Methods", "Arithmetic Methods". Practice teaching has historically meant placing the student for a period of time, varying generally from several weeks to a full semester, in a classroom with an experienced teacher.

Teaching-Learning Process

Historically the measure of good teaching was related to the teacher's ability to bring the appropriate material to the student (i.e., her ability to _present_ and _cover_ the curriculum). To be sure, good teachers were more _versatile_ in _their_ presentations and more complete in their coverage. This view of teaching lends validity to the proliferation of methods courses in teacher education programs!

In this context one might wonder how teaching effectiveness was evaluated. I'm not sure. I believe versatility of presentation may have been one criterion. I suspect that a second criterion was average class standing on standardized achievement tests. However, as obvious as it now seems, I doubt that teachers were ever evaluated according to their ability to have _every_ child gain from the teaching-learning process. In other words, most learned, some didn't. The teacher could not be blamed for those who didn't since the fact that most learned - some exceptionally well - was evidence that the material was well covered and well presented by the teacher. The slow- or non-learning child was his own or his parents' problem, not the teacher's. If the teacher presented the material well and a few children failed to grasp it, the teacher succeeded and those children failed.

Present Status

Although one can easily despair over the little progress that has been made in public school education in the past two or three decades, there are presently several islands of hope and broad patches of progress. Institutions, especially public, non-profit institutions, generally are inextricably tied to their past. Left to their own devices, and without massive pressure and a new infusion of creative thinking, they tend to recapitulate in their own image that which has gone before. In this context, the following points regarding current status, preparation and the teaching-learning process seem valid and relevant.

Status

The declining prestige of the teacher appears to be leveling off and his influence and importance in society is on the rise. The influential voice of parents and pupils that began to be heard in schools after World War II is now becoming part of the modus operandi of public education. Initially this intrusion of democracy shook the autocratic bulwark against "outside" interference established by teachers and public school administrators. In so doing it contributed, along with the factors mentioned above, to the lowered status of the public school teacher. However, the challenge has positive results, and is leading to a new and more meaningful interaction between school and community. As schools become more responsive to and work closer with parents a new respect for teachers and their role in American society is evolving. Thus, to some extent, one of the factors that contributed to the declining prestige of teachers also is responsible for the restoration of respect.

But other equally important factors are affecting teachers' status. Most influential is the role of the Federal Government, particularly the Office of Economic Opportunity and the U.S. Office of Education. It was the Federal Government that first enunciated the fact that our schools must be a place where all children learn - not just the children from middle and upper class homes. The government drove home the diminishing employment outlook of the uneducated and unskilled. It focused on the role of the school in feeding the cycle of poverty. In so doing, it rekindled in the public - at all social class levels - an interest in the teaching process.

In the past schools were a closed system. They operated in a world unto themselves. That day has passed. Their successes and failures now are judged by a different yardstick. The Federal Government, the middle class public and, most of all, the disadvantaged parents are making schools and teachers aware that when a child does not learn it is the school and the teacher that have failed - not the child and his family. Thus, it seems that once again teachers are becoming an increasingly important force in society.

Preparation

One of the most obvious and dismaying aspects of current teacher education programs relates to how little they have changed. Today's teaching intern receives essentially the same program as his counterpart of twenty years ago. The technological explosion has resulted in an added course in "Audio Visual Education" and perhaps a cursory demonstration of teaching machines, and the anti-poverty movement has contributed several courses on teaching the disadvantaged. But no real investigation of the relationship between technology and education has been encouraged. In fact, many college professors scorn these innovations and, because they are threatened by them and don't really understand their capabilities, they place greater stress than ever on the importance of face to face and interpersonal relationships in teaching. They talk more than ever about individual differences and meeting each child's needs without ever understanding technology's ability to contribute to these ends. Even more discouraging, they refuse to acknowledge that in a society where all children must learn, their approach falls short of the mark.

Lest I leave the impression that my purpose is to unmercifully attack teacher education programs, let me hasten to add three points of defense. First, teacher education was doing a very adequate job when educational philosophy took the position that an adequate presentation of material constituted good teaching. The concept that we must educate every child is still new. At no time in the past did anyone feel it was the obligation of the teacher to see that all children learn. There were plenty of opportunities - indeed there was a need - for the unskilled and semi-skilled.

Second, teacher education programs are institutions in the same sense as school systems. Like all non-profit institutions, they are slow to change without pressure. Consequently, most teacher educators develop programs similar to the one in which they were educated; and most new teachers, regardless of the content of their teacher education program, tend to teach as they were taught. And so the cycle goes on.

Third, few of the technological advances available to education have been meaningfully brought to the attention of the professor of education. Salesmen, yes; but a concerted effort by industry to demonstrate the potential of their wares in practice, no. The professor of education is a practitioner, not a researcher. He will stretch for the new and innovative only if he sees that it will make him more effective and if he understands simultaneously that his basic concepts about education can be preserved and enhanced. Most professors of education see the application of technology to the classroom as a need to compromise the relationship between teacher and pupil. Until this barrier is overcome, the potential improvement in both teacher education programs and public school systems will be pathetically slow.

Teaching-Learning Process

Perhaps I am being unfair to both industry and education but for purposes of argument I propose the following two theses: (1) Industry has failed to educate the professional educator as to the potential of its contributions to the teaching-learning process. (2) Educators have failed to look ahead even one decade. Consequently, the past has caught up with them and they are still unaware, for the most part, of the present problems or future demands of public education.

A decade ago I heard George Stoddard, former president of the University of Illinois and a distinguished educational psychologist, express the notion that it took 50 years for an established principle in educational psychology to become practice in public education. Presumably the time lag would be shorter now. Nonetheless, can we wait even a third that length of time (almost one generation) to combine our new knowledge of learning principles and technological know-how and apply them to the teaching-learning process in our schools?

I began this section on the present status of education by mentioning islands of hope and patches of progress. One island of hope is this conference - and others like it - devoted to looking at the future of

American education from a variety of perspectives. Interdisciplinary approaches to the problems of education will not only hasten innovative solutions to our present dilemma, but also forecast future problems so that they may be anticipated and dealt with before their full negative impact is upon us.

Patches of progress are numerous. There are several programs of truly indiviudalized instruction in school systems. Many of these programs have embraced technology as a tool to better teaching and thus have recognized that along with the chalkboard, textbook and other teaching tools technological innovations can be used to enhance the teaching-learning process. The leaders in these programs present concrete evidence that individual pupil needs and differences can be better met, rather than neglected, when wise use is made of man-machine systems. They also demonstrate in practice that teacher-pupil relationships are improved rather than diminished when appropriate tools are wisely used.

Programs of Federal aid to education are beginning to support and encourage new and innovative approaches. Last year I co-directed two seminars for 30 pilot programs in early childhood education which aim to "Follow Through" on the gains made by disadvantaged pre-school children in Head Start. Time and again at these seminars the position of both the Office of Education and the OEO supported innovation and experimentation. The same approach is becoming evident in Federal Programs at the college level. It seems clear that individuals representing the Federal Government now fully recognize that what is needed is not more of the same, but rather something new.

Although not yet fully successful, the concept of the ungraded primary class presents a forward looking approach to breaking the lock-step pattern that has historically prevented teachers from recognizing individual differences in rate of learning and learning styles of children. One reason for the limited success of this approach is that an ungraded primary feeds into lock-step grades from fourth on. Moreover, teachers either unaware or unable to accept actual differences in learning rates of children, tend to use the ungraded first 3 grades as a means of holding the slow learner for an extra year. Rarely do they accelerate the fast learner. Nonetheless, the ungraded primary concept has the germ of a beginning approach to programs of individualized instruction.

The Future

One of the major problems in public education is the "teacher shortage". The demand for certified teachers increases each year. I have heard predictions of the total need for the next decade as high as 60,000. Even if salaries of new public school teachers were magically doubled and if the public image of teaching were tremendously improved, we could not hope to fill the need. It is obvious that to proceed full throttle on the present course will not make matters better. The declining birth rate only means that the increase in numbers of children to be educated will slacken somewhat; it does not mean there will be fewer children in school. New legislation will enable the U.S. Office of Education to support training programs for sub-professionals such as teacher aides. Programs of this type provide a new avenue of employment and they may make for more effective instruction in particular classrooms, but they will not necessarily reduce the need for teachers unless some additional steps are taken.

There are several alternatives to the impossible task of preparing astronomical numbers of new teachers in the next two decades. Every alternative I can present is likely to have some shortcomings, but at least two deserve exploration.

The first position is rather unidimensional. My only contribution is to indicate some possible shortcomings of the approach that may not be readily apparent. The second suggestion is multidimensional and includes a segment of the first approach. Since at least part of the second proposal is original, fewer shortcomings are evident to me.

One of the most commonly proposed solutions to the problems of education, most vigorously supported by anti-poverty specialists, is the career-ladder concept. This proposal suggests employment of poor, minimally educated people in jobs such as teacher aides. Then, by a combined process involving experience, in-service training, and a small number of specified higher education courses (hopefully offered by local community colleges) the aide moves one step up the ladder. Perhaps the second step is teaching-assistant. After more experience and a few more specified college courses the teaching-assistant become a teacher.

Although I am not basically opposed to the career-ladder concept and can certainly appreciate its advantages in reducing the teacher shortage, I feel an obligation to point out some of its inadequacies. For one thing, widespread use of this approach, as proposed by anti-poverty specialists, means more and more teachers who have poor formal schooling. Their lack of a full college education in an educated society is likely to reduce the impact and status of teachers. Moreover, we face the danger of creating a dichotomy of two classes of teachers within the profession. Although the anti-poverty specialist has a point in arguing that teachers from a poverty background are more likely to "reach" the children of the poor, they don't suggest that career-ladder persons be certified to teach only the poor. One can't help but wonder whether they will be able to "reach" and adequately teach the 70 to 80 per cent of the children who don't have a poverty background. Given a choice, I'm sure that middle class parents will want college educated teachers for their children.

Although it is not my purpose to belittle the anti-poverty specialist, I can't help but wonder whether he would be equally willing to have his appendix removed by a career-ladder surgeon as by a boarded surgeon with formal medical training and a residency in surgery. In a word, the concept of a career-ladder may have merit, but when applied to a particular social group, such as those in poverty, perhaps it should stop short at some point below the level of teacher. The present dilemma in education casts doubt on the relevance and value of current teacher education programs, but this condition does not in any sense support the notion that a minimum amount of college education will produce a teacher as good or better than one with a college degree. Finally, the career-ladder concept in education has one other shortcoming. It implies that the entry level position - let us say teaching aide - is automatically an unworthy one, to be moved out of as quickly as possible. If the aide concept has value in education, perhaps it would be better to encourage tenure by building in salary increments. Thus, we might have something equivalent to Aide 1, Aide 2, Aide 3, and so on. This system is workable with clerical personnel, why not with teaching aides?

The second approach to solving the teacher shortage is increased class size. I'm sure this suggestion is appalling to teachers and teacher educators. But this approach, combined with the concept of teaching assistants and/or teaching aides deserves investigation. We might best begin to examine this proposal by redefining the term "class". Earlier, I mentioned the ungraded primary concept. Expand this approach, if you will, to include the ungraded elementary school - or even the ungraded public education system. Envision, for example, 120 8-year old children assigned to a single teacher-leader, who has a staff of 2 or 3 teaching-assistants (at least two years of formal higher education or a degree in an area other than education), and 5 or 6 teaching-aides (minimal formal education).

Let us further expand this notion by including not only a traditional in-service training program mounted, maintained and monitored by staff in the school system, but also by a core of teacher-educators, who, hand-in-hand with industrial technologists, have finally begun to objectively appraise the applications of man-machine systems to the educational process.

In this complex, new "class" there will have to be a careful definition of who does what. A pupil appraisal system will need to be established and maintained, a program of individual pupil instruction must be instituted, instructional materials will need to be maintained, and so on. A host of out-of-class services and activities will need to be inaugurated and integrated into the educational program. This approach is more complex than one certified teacher, and perhaps one aide, to every thirty children, but new technology, combined with the concept of individualized instruction not only makes it feasible, but also holds promise for a better instructional program for all children.

The foregoing proposal provides an adult-pupil ratio of between one to twelve or one to fifteen. It immediately lends itself to the criticism, however, that only one fully prepared teacher is available to 120 children, thus there is the possible neglect of individual differences and individual pupil needs - especially in the social and emotional areas. But this can be handled as an integral part of the in-service training program, especially if ancillary personnel such as social workers, school psychologists, learning psychologists, guidance counselors and others are part of the in-service team. It is well worth remembering that not all children will need special attention. Even most of the younger children will be happy in the program as long as they have an adult to relate to and to feel at home with. The reduced adult-child ratio increases this likelihood. Greater individual attention to those who need it is also more feasible than in the single classroom where one or two adults are responsible for 30 or 35 children.

Most important, the proposed program enables each child to move along in every area of instruction as rapidly as his capabilities permit. Well defined instructional goals and evaluation criteria could enable the instructional staff to introduce new material as the child is ready for it rather than as the teacher's guide calls for it. Only the most hapless bungling could fail to improve over our present educational procedure. A well developed program might even enable the teacher to evaluate what the child knows rather than, as is usually the case now, what he doesn't know.

By way of concluding the discussion on the proposed approach, we should look briefly at procedures for selecting the auxiliary staff - assistants and aides. Rather than selecting persons who represent a particular social strata or racial minority, as is proposed by the anti-poverty specialists, I would favor selection on the basis of specified criteria which reflect the needs of each individual program. The goal is a full education for all children, not only the poor or the black. There certainly would be groups and on-the-job functions which would favor auxiliary persons from economically disadvantaged backgrounds; but other situations might call for a teenager or middle-aged retired person. The point here is to let the nature of the group and the requirements of the program be the principal factor in determining the staff.

Let us now turn our attention to teacher education programs. It seems almost axiomatic that professors of education need to join forces with technologists. They also need to add to their staffs competent, creative learning theorists (there are some) so that in the decades to come we can examine more closely the relationship among man-machines, learning and motivation, for all ages of children from all types of backgrounds. It is essential that closer ties be developed between teacher education programs and school systems. They need each other. One of the problems in education has been the lack of feed-back.

It will be recalled that I earlier indicated a belief that teachers teach as they were taught. To the extent that this assertion is true, it behooves teacher educators to begin now to incorporate the benefits of technology into their programs so that two decades hence we will have a generation of teacher educators whose own teaching was flexible and individualized. Most important we must continually remind ourselves that not only is there a population explosion, but also a knowledge explosion. To attempt to teach a child what is known rather than how to acquire information is an impossible goal. Even if it were possible at any point in time, it would be fruitless since knowledge is expanding at an increasing rate. The goal of education for the present and for all the decades to come must be to equip the child to be a life-long learner who can and wants to independently pursue knowledge.

At the outset of this paper I stated that its title implied that in the final analysis the teacher must assume responsibility for the teaching-learning process. I believe this implication to be valid. However, the teacher must have help. He can no longer do an effective job by "presenting" material to 30 pupils at once. I have suggested some methods of providing that help. If the suggestions have merit, then how do we begin the processes of implementation? If the suggestions fall short of the mark, then what new alternatives are available?

EDUCATIONAL INFORMATION SYSTEMS AND EDUCATIONAL FINANCE AND ORGANIZATION

by Frank Farner

Finance and organization are the key to performance of the educational function. The many excellent predictions of information system needs in education which are the content of the companion papers of this conference are dependent upon adequate financing and suitable organization. Neither finance nor organization can be viewed as a goal in itself - only as a facilitator of improved instruction and guidance.

But, no facets of the educational enterprise are destined to change more in the decades ahead than are finance and organization. And, no facets are more related to the use of sophisticated, computer-based information systems.

Prospective Changes in Educational Finance and Organization

A group of easily identifiable prospective changes in educational finance and organization provides an organized means to envision logical applications of educational information systems. Most of these changes are already under way, allowing little question of their validity.

Greater Federal Involvement

The foremost change in educational finance and organization to be foreseen in the decade ahead is greater involvement of the federal government in educational finance and control. By "control" I mean to imply organization. Specialists in finance have no hesitation in predicting that school financial support in a decade will become a three-way nearly equal partnership - local, state and federal. Now this partnership is not at all equal with, on a national average, the proportions, being about 50% local, 40% state and 10% federal. There are, however, great variations in these proportions among the states, especially the two non-federal proportions. Of course, Hawaii, with a state school district and no local districts has 100% state support. In Alaska and Delaware state support is over 85% and it is high in Washington and Nevada. For example, the percentage of state support in Washington and Nevada is more than twice the percentage in Oregon and California. Nebraska, with the largest number of school districts and, therefore, the greatest disparity of local ability, has, lamentably, a very low percentage of state support, only 5%. Local property taxes must fill voids in state support and this phenomenon leads to school finance crises in states. Even when the three-way equal partnership is acheived it will be on a national basis only. The federal share may be quite consistently about 30-40% in every state but the remaining 70-60% may be shared quite differently from state to state.

The prospect of greater federal support, of course, implies a greater availability of funds. It has been the lament of school men for decades that the largest tax collector, the federal government, was dormant in the nation's greatest social service - education. It also implies some federal control, for who can expect support without control? Who would even want it?

Greater federal support increases the importance of financial and organizational analyses of performance to determine the proper focus of increased support. But, there is really no reason to confine this principle to federal support. More will be said of this need in later pages.

Centralization

A second major change in educational finance and organization which will materialize in the decade ahead will be a steady continuation of a trend of 40 years toward greater centralization of control of the educational function. District consolidation will continue apace. In areas where consolidation of districts has reached the maximum limit of public opinion and when approval still falls short of optimum organization, regional or intermediate units will come into being.

State departments may or may not participate in the centralization trend. State departments will **flourish** if they can provide important, useful services to districts and regional units and provide effective liaison between the federal government and districts. But if state departments remain traditional, bureaucratic and harassing, they will lose their role in educational finance and organization. State departments probably retain a choice regarding their fate in this decade of change but time is running short and self-reform is essential for survival.

Inter-state and even national compacts will arise. National organizations of districts or regions with similar problems will become more common.

Decision Making from a Data Base

The third change in finance and organization to be anticipated simply follows logically from the second. Educational decision making will move from a know-nothing or informed guess base toward a data base. The day, already passed in some places, of the superintendent and board chairman carrying the financial affairs of a district around in their heads and/or their hip pockets will be completely gone. Eventually, the quasi-informed administrator and board member of today will become a thing of the past. Legislatures are in great need of a data base for decision-making questions such as how much did our disadvantaged education program cost last year, or how would a proposed change in our fringe benefits programs affect our budget next year, are going to be asked by educational decision-makers. Furthermore, the questions one asks are not going to be only about one's own district - comparative information will be sought. Hypothetical simulations will be expected. Centralized units and/or control agencies will expect, and demand, information about costs and performances beyond our greatest imagination. But this burden will be bearable, even desirable, if we can base our decisions on facts and principles rather than hunches, guesses, prejudices and traditions as we now so often do.

A Shift in the Relationships Among the Board, the Administration and the Faculty

A fourth major change in educational finance and organization will be a shift in the relationship of power regarding educational decisions among the three principal opinion groups - board (public?), administration and faculty. Teacher salary negotiations will become more formalized and impersonal. Regional, even state, consolidations of this important function will be likely. The superintendent will inevitably lose his ability to represent both the teachers and the board and will become the board's executive.

Perhaps it is no compliment to the superintendent to note that as his shift toward the board occurs, the strength of the faculty in decision making will probably increase.

Four important prospective changes in educational finance and organization have been listed:

1. Greater federal involvement
2. Centralization of finance, organization and control
3. Decision making from a data base
4. A shift in the relationships among the board, the administration and the faculty

Implications of Prospective Changes for Applications of Educational Information Systems in Educational Finance and Organization

Four rather specific educational information systems implications arise from the prospective changes. It is convenient to list and describe them as four implications, but they may well be so inter-related that they constitute a single system.

Program Budgeting

The need for information for educational decision making in finance and organization, especially finance, is going to far exceed the capacity of our current financial accounting practices. Today we are really able, in most districts, to analyze educational expenditures by account classes and sometimes by very broad functions such as salaries, supplies, equipment, etc. We must be able to expand our system to include analyses by program. Perhaps the journalese questions, who, what, why, where, when and how are appropriate questions to ask and answer about each educational expenditure. And so, today's usual three- or four-digit account class code will become and eight-or ten-digit answer to these questions and permits a geometric expansion of the ways cost data can be put together to answer program analysis questions. Systems approach in this field will require effective massing of expenditure data and, perhaps even more importantly, effect "question asking" by the decision maker who is using the system. Greater awareness of the system's ability to answer cost-benefit questions is a crying need.

Retained, Retrievable Data

Of course, computer-based systems are mandatory to simply record the kind of detail envisioned and then to recombine it, simulate it, project it and recapitulate it as required. Historical perspective will become crucial, implying a need to retain data in retrievable form for some time.

Larger Service Areas

Only very large districts will be able to efficiently generate and support the type of finance and organization information systems required. The trend toward consolidation of regions for actual educational finance and organization will be paralleled by consolidation for the information system function which will naturally evolve from the change in finance and organization. The OTIS Project is an example of this trend as are regional units in California, Florida, Tennessee and other states.

Recognition of the National Nature of Some Information Needs

Comparative educational data for the entire nation is certainly going to become a logical element of district, regional and state educational information systems. Perhaps that portion of a district's system which should be a part of a national system may be only 10% of the district's total. But surely such need will exist, indeed it already does.

For example, one educational factor which is not permanently physically located is the student. We are very deficient in data regarding national student mobility and we shall remain so until an annual national school census becomes a reality. An information system to encompass a national school census threatens the imagination and may exceed current public opinion receptivity. But, we must know more about student mobility from school to school, from school to job and from school to that form of limbo attained by the drop-out who becomes unemployed. The effectiveness of and the need for programs demands such measurement data. When we really come to the point of assigning student identification at birth and locating every student each year through the educational years we will have come to a landmark point in the evolution of educational information systems.

Simulation Applications of the Information System

One of the most promising areas for computer application in educational finance and organization is the simulation of varying courses of action - new tax programs, new teacher salary schedules, new forms of organization, new educational programs. Generation of information is not enough. Imaginative methods of utilizing the data in the system to answer decision-making questions is essential. National interchange of the methods for and results of educational simulations will surely evolve.

The Climate of Change

Five finance and organization applications of educational information systems have been listed which would rather naturally follow the four prospective changes listed earlier. The substantive changes themselves may well be less traumatic to the educational enterprise than the introduction of new, detailed methods of coping with the broad changes.

The concepts of administrators, board members, faculty and other decision makers will be easier to adapt to new methods and systems, than will be the day-to-day traditional functions of other employees. Concepts change more readily than practices.

In any event, the period of adjustment to an expanded and ever more complicated use of computer technology and enlightened self appraisal in any area which has been traditionally one of mystique and intuition will be difficult.

The role of the administrator in moving toward what this paper seems to describe as an inevitable position is difficult. He must studiously avoid the temptation to let the information system become the educational system. Those sensitive arts of teaching, creating, motivating, and administering must remain subordinate to the sciences of reporting, accounting, analyzing and simulating. Hardware stores are more fascinating than softwear stores to most administrators.

CONTRIBUTORS TO AUTOMATED EDUCATIONAL INFORMATION SYSTEMS IN THE 1980'S

by Lowry M. Bennett

Preface

Project O.T.I.S. (Oregon Total Information System) was originally conceived by a number of local school administrators working closely with the Oregon State Department of Education. These far sighted educators recognized the increasing pressure on local and state educational agencies for complete and current information.

They realized that the cost of developing complete automated information systems for the many small school districts in Oregon would be prohibitive unless resources were jointly shared and activities were coordinated.

A proposal for a 20-month planning grant was submitted to Title III E. S.E.A. 89-10 and was accepted by the U.S.O.E. in May 1966. The purpose of the planning phase of the project was laid out in four steps: 1st - To survey the information needs of Oregon's schools, 2nd, To analyze the survey in order to develop priorities and to establish data relationships, 3rd - To design the system or systems required to satisfy the identified needs, and 4th - To develop and test the programs and systems required to demonstrate the design.

The director of the project was hired in August of 1966. Selecting a quality staff proved to be a very difficult task. Identifying, interviewing and hiring data processing analysts with specialized talents consumed the first 60 days. With the staff on board a critical path was developed and tools for conducting the survey were developed. The Bureau of Educational Research at the University of Oregon was contracted to help with the survey, and work with local school districts was started. The survey, analysis, and design are completed and the computer programs are being debugged and tested. Project OTIS has recently been refunded by the U.S.O.E. for a three year demonstration to begin May 1, 1968.

The three year demonstration phase will begin May 1, 1968 with thirty six districts from all over the state of Oregon tied directly to the OTIS central computer via leased telephone lines with 75 keyboard terminals. Services will include all normally desired management services, including payroll, personnel accounting, grade reporting, school sectioning, modular scheduling and others.

Students in local districts working with OTIS will in addition be able to enter computer programs via the terminals for use in solving problems for any appropriate course work.

The board of Directors for OTIS is presently the Lane County Intermediate Education District Board. The board has directed the OTIS administration to make plans for either moving the program to work under the direction of the State Department of Education or to build a non-profit organization with a board of directors selected by the Oregon Association of School Administrators.

Many other school districts in Oregon have already indicated an interest in starting to work with OTIS beginning in July 1968. Considerable interest has been shown by other states and districts across the country.

The staff at OTIS is proud of their accomplishments to date, but is very aware of the excellent help and support received from other existing school data processing centers. Without the help and guidance of these centers OTIS would not be what it is today.

Introduction

Will there be automated educational information systems in two decades? I have very little doubt that there will be, but what are the activities currently going on that are major effectors of the development of such systems? Educators have given very little time to the analysis of current efforts as they related to future systems. I can imagine many exciting and worthwhile functions of an automated educational information system of the 1980's, but I believe we must first of all honestly assess the present.

This paper will briefly cover a few of the more critical problems facing computerized educational information system designers in 1967. I will support the position that we cannot and should not speculate the future in any detail until we have met today's information problems more adroitly. I will also take the position that no completely sound foundations exist in educational information systems design. The technology exists; the interest of educators is increasing; the educational information system problems we face can be solved with determination and skill.

> What can EDP do for school administration? The uses of the computer and electronic data processing (EDP) in administration of public education are limited only be the imagination of professional administrators. The time has come to stretch this creative potential. (1)

The project OTIS (Oregon Total Information System) staff has, over the past 14 months, visited in over 100 school districts across the nation. We have attempted, during our visits, to analyze the organizational structure, the operational procedures, and the general climate of each district we have visited. We have identified some common goals and some common problems facing each of these districts. The pitfalls that have been pointed out by the directors of these educational information systems have helped us greatly in the design of our own project. The project OTIS staff has designed a system which consolidates many of the good features of those we have visited and attempts to avoid the pitfalls that have been identified for us. I will discuss OTIS in more detail later in this paper.

The Problems

Education is changing. John W. Loughary, Professor of Education at the University of Oregon, in his book, Man-Machine Systems in Education, states "The scope of complexity of education is itself one of the most difficult obstacles to closing the gap between technology and educational practice." (2) It seems almost trite to spend time in discussing the changes that have been and are occurring in education, but the point is so critical to information systems design that I must brief the most significant points.

The changes that affect educational design fall basically into three categories. The content of the public school curriculum is increasing. New courses dealing with disciplines never before attempted in the public schools are now being offered. With these new courses come requirements for staff with different orientation and training supplied with new materials and facilities. As the number of courses increases, educators are finding themselves even more confused in terms of which particular classification each course should fit into, what the objectives of the course are, how this course relates to other courses in the curriculum, and the value of the new course to the overall objectives of the institutions. Granted, it will be soon generally accepted that learning does not necessarily lend itself to neat, concise categories of learning. Nevertheless, within the structure of existing schools, these courses must be included. They frequently are expected to conform to the rigid traditional department lines that have been adopted.

The addition of new courses to the curriculum is not the only expansion in scope that is occurring. In analyzing and designing an information system for schools, the characteristics of the student involved play a significant role in the system adopted. Students attending public schools are no longer limited to those grades K through 12 nor, chronologically speaking, ages 5 through 18. Every member of the community is a potential consumer of the curriculum being offered. Night school programs and extension offerings are designed primarily for adults who are in the process of updating their skills or knowledge. Even retired community members are showing interest in the public school curriculum offerings.

The educational environment is changing in depth as well as scope. New knowledge and interpretations in all fields are multiplying at an unprecedented rate. General statistics released depicting the knowledge explosion give an unrealistic picture of the specifics. Figures available are frequently obsolete before they are published. In summing up these three points, we might say that curriculum of the school district of 1970 is rapidly changing to meet the demands put upon it by the community. The student involved in the curriculum is no longer age 5 through 18 but, in fact, may very well encompass the entire community. And, lastly, the information explosion creates for educators and the general public a problem that may be impossible to solve with existing education structures and methods.

The second problem facing designers of educational information systems is that educators are extremely limited in experience and understanding of the emerging technology. In the hands of the knowledgeable, today's computer becomes a powerful tool that can be used to handle problems of volume and complexity in attacking educational problems. Educators in general, however, do not understand the computer and, therefore, are capable of only minimal use of this powerful tool.

> Educators must be concerned about computers, must learn about them, must teach about them. They cannot ignore them. The computer is not going to go away. Its effects will not fade, its use will not decline, its influence will not disappear. After a dozen years, this much is surely obvious. (3)

Even to the trained and knowledgeable data processor, the computer is a challenge. Continuous study to maintain pace with hardware changes must be a part of the up-to-date professional data processors' lives. Changes in programming languages, operating systems, terminology, storage techniques, analysis theory, and documentation techniques create updating burdens for the information system specialists.

Today's computer technology, if history serves us right, is a poor prototype of the computer science that will be in existence in 1980.

Educators have generally ignored the responsibility of learning about the new technology. This posture seems to be changing, but a half-hearted, reluctant attitude toward this change can only serve to isolate the educator from the systems he will be operating.

In attempting to design an information system for a particular organization, it is essential that we learn all we can about the unique characteristics and requirements of that organization. Systems analysis is a very new profession. The tools used in the analysis of systems can be classified as primitive at best.

If we agree that the educational environment does not lend itself totally to quantitative analysis, it follows that a modified approach in analyzing the educational systems must be followed. The usual approach that has been adopted is to analyze and document in detail the existing operations. With this approach, seldom are objectives related to the activities involved. Numerous changes are forced as staff members search randomly for "better" ways of doing things. The systems that have been built following this technique have been only partially successful. The need in designing and analyzing educational information systems is not only to know what has been done, but, in addition, to understand the relationship of the system's data elements so well that generalized programs can be developed. Designing an educational information system in this manner will provide educators with unlimited flexibility to meet their ever changing needs.

A brief comment with regard to cost of computerized information systems seems appropriate at this point. This factor continually becomes one of the most controversial issues whenever automated educational information systems are discussed. In my own experience, I have found that once objectives and programs were clearly defined, educators were willing and eager to collect the required funds. The key to this approach, it seems, is to initially eliminate the magical quality of computerized systems and to put the whole business into context through accepted educational terminology.

The cost of computerized educational information systems will continue to be a problem nation-wide until school districts jointly utilize the dollar resources available to them. School districts have traditionally fought the hardest to save their own autonomy. Educators look at automated information systems as their most feared enemy with regard to the maintenance of this autonomy. This fear is not without sound logical base. Any two persons or groups who band together to cooperatively meet their joint needs must both give and take. Our position at Project OTIS is that this involvement between educators and school districts with different experiences and different backgrounds has the effect of creating an educational environment for all of those involved that will be superior to what one could do in isolation. If this assumption can be substantiated, school districts will band together to build information systems at a cost which is acceptable under today's standards for meeting their information needs.

My last problem is more of a concern than it is a problem. As an educator, I feel that some of the science (or art) of education is very difficult for non-educators to appreciate. In order to be a successful teacher, one must have what has been many times called heart. School systems are not cut and dried manufacturing plants that take raw material in the front end and turn out bolts and nuts in the rear. Granted, students come in the front door at age five, and if our initial position is accepted, throughout the rest of their lives they will be learning. They will leave the educational institution with improved skills and new understanding. A truly successful educational information system that meets the needs of education today and can be easily modified to meet the new challenges and pressures must be developed in a large part by educators themselves. My concern comes about when I recognize that many people other than educators are seeing the educational field as a reservoir of dollars and power that could improve their personal or corporate positions. Private industry and large government groups have much to offer educators in the way of techniques and leadership in the development of information systems. This help should not be refused. Dollars and mistakes can be minimized if existing tested techniques for developing information systems are studied and used. I believe that currently more activity and interest are being shown by groups outside of education than by educators themselves. Educators appear to be quite willing to allow others to take the leadership in developing information systems to meet the needs of their own institutions. When overt activity is required of the educator to involve himself with these outside leaders in the development of his information systems, he is generally reluctant. The recognition of the possible dangers of this approach must be clearly understood. Systems built for educators must dynamically involve educators if they are to truly meet the needs of education.

The staff at Project OTIS is conversant with the problems discussed in this paper. As a result of our initial analysis, we are convinced that there will be in existence sophisticated information systems built by educators operating in an educational environment by 1980. We as a group are not overly impressed with approaches that attempt to overlook current problems. We believe that many excellent efforts have been and are being carried out and that, while in themselves, may not have been completely adequate, can serve others in providing excellent guidelines for present systems analysis and design efforts.

The staff at Project OTIS represents over 70 years of data processing and educational experience. As a result of the many visitations to operating data processing centers and conferences with educators at all levels, we have designed an information system for implementation in 1968 that we believe will put education well on its way to meeting the problems that will be existent in the 1980's.

The first parameter that we approached in attempting to develop the Oregon Total Information System was the cost. Educators in general and the public are conscious of the relatively "high cost" of data processing equipment and personnel. We at OTIS have been extremely fortunate in having been funded by the U.S. Office of Education to establish an educational information regional center in Oregon. Through the help of the USOE, we have been able to defray part of the initial costs to the local district and have developed a planned program which can be phased in such a way that the cost estimates per student fall in line with what our educators in Oregon consider to be "reasonable expectancy" by 1971. This has been made possible by bringing together a large number of school districts utilizing one central computing center and staff. The major problems facing educational institutions today are not problems that can be solved on small computer systems. An example of this type of problem is modular scheduling. Regardless of the size of the school involved in modular scheduling, if a computer is required, it must be a relatively large-scale system. Those school districts who require the use of a modular scheduling program have gone outside of the state of Oregon and contracted for services. Consolidation of these funds alone will help to support the required computer center and staff.

Considerable time and effort are being spent by school district personnel in many of the districts in the state of Oregon and in developing plans for adopting automation in their individual districts. Coordination of these activities has not been carried out, and it is apparent that the direction these educators are prone to take depends to a great extent on the latest bulletin they have been exposed to. Coordination of the efforts of these educators by trained experienced staff will serve to provide the leadership for the OTIS effort. The Project OTIS survey indicates that, by jointly utilizing the time, talent, and dollar resources of education in the state, we can support an information system capable of meeting today's needs as well as growing to meet future demands, at an acceptable cost.

Project OTIS is designed to be implemented in four separate groups which have been dubbed waves. The first wave of students includes some 88,000 students, K through 12, representing 36 school districts strategically located in various parts of the state. Coordinators have been selected and hired, at local district expense, for each of these districts. These coordinators have worked with the educators in their districts in analyzing existing systems and in carrying on in-service training programs with local district personnel. This activity is absolutely essential prior to any actual machine processing of records. Coordinators representing Wave I districts began working with the OTIS staff July 1, 1967, and will receive their first computer processed reports July, 1968. The second wave of users will represent some 75,000 additional students. The coordinators from this group will begin working with the OTIS staff July 1, 1968, and will expect OTIS produced reports July 1, 1969.

By the end of the fourth wave, it is projected that OTIS will be providing services for school districts representing some 250,000 students. With a student body base of this size, OTIS can be supported through local funds at a cost that is considered to be "reasonable" by educators in Oregon.

In surveying the various systems around the United States, the OTIS staff discovered that one of the largest cost factors and time binds in educational data processing was the continual reprogramming that occurred as a result of changes requested in reporting formats and data. It was discovered that some data processing centers were required to reprogram their major applications every 12 months. Reprogramming of these applications is very costly and time consuming. Changes requested in mid-year were often ignored until the new fiscal year or school year began. This inflexibility created, in the minds of educational administrators, questions and serious concerns regarding the potential adaptiveness of automated information systems to education.

The overall design of Project OTIS software system is based, in a large measure, on what we call our Generalized Education Management System (GEMS) software package. GEMS consists of a series of internal computer programs and control tables. The content and format of the input documents and output reports can be modified easily by making appropriate changes to these control tables. Each school and/or district will have its own set of tables so that the system is tailored to their individual requirements. Rather than having an individual program for each district, only one set of generalized programs will be required. GEMS will allow for maximum flexibility and expansion by providing the capability to add, delete, and alter input, output, and data storage by changing tables rather than by rewriting computer programs. The coding of the GEMS program is well under way. The scheduled date for their completion is summer quarter, 1968. The availability of GEMS to Oregon educators will give them an opportunity to maintain their autonomy and unique reporting desires while enjoying the flexibility and power desired by all school districts.

During the initial study of educational information systems, the project staff found that considerable effort had been carried on by the U.S. Office of Education in identifying what they termed the "five magic areas." These five areas are student, staff, property, curriculum, and fiscal. The U.S. Office of Education has spent years in defining and classifying the contents of these five areas. The project staff determined that we would include all quality efforts that increased our efficiency. We agreed that time could be saved if we were to utilize the existing definitions and coding structures as they had been developed by the U.S. Office of Education in their published handboods. Our analysis indicated that a minimum amount of modification would be required to satisfy our Oregon needs and that our systems could handle future modifications as they were made. These five files will be stored in an integrated information data bank. This will give the opportunity of using any field of data from any one file with data from any of the other four files to produce reports. By coding this data in tables, the GEMS program will have access to the data required to provide any desired report from the data maintained in the files provided the report format is stored in the output tables.

The integrated data bank will be broken into segments. Each segment will relate closely to a major report required by the educational users. These segments will be variable and can be added to or deleted from by changing GEMS tables. The five files of data will be stored on random access devices. Frequently used segments will be stored on high-speed disks and less frequently used data will be stored on slower data cells. Historical data collected or generated will be stored on magnetic tape for batch processing on request. We anticipate the experience of the first year of operation will change our initial data storage schemes appreciably.

The question of teleprocessing in educational information systems has long been debated. So long as educational information centers were involved in a batch processing, application oriented system, the individuals who supported the position that teleprocessing was too expensive to include seemed to have the upper hand. When the systems changed to an integrated data base where, theoretically, all information depicting the characteristics of the individual school district could be stored, the picture changed considerably. Once the data for a dynamic integrated data base was collected, its value remained only so long as it was currently maintained and readily available. This maintenance has been a critical problem for centers who have attempted to gather and store large amounts of data. When it was determined that the OTIS concept would include applications that required information from all five files, it was decided that district personnel must have an easy way to maintain those files, and even more important, an easy way to assess those files regarding their current status.

> A storehouse of data--the data base--which forms a part of a data bank is not defined in terms of location, but in terms of accessibility. It is not the presence of a thing, but rather the access to it that is central. (4)

It was apparent that we must establish a teleprocessing network if we were to develop a truly integrated system. We felt also that, once school district personnel were acquainted with the potentials and limitations of data processing terminals, they would be in a better position to show leadership in determining future computer uses. We felt, for example, that this environment will serve as an excellent opportunity in preparing educators for the "CAI" environment of the future.

Our initial contacts have indicated enthusiasm on the part of Oregon educators to accept the teleprocessing keyboard terminal for maintenance and inquiry to the system. The cost of our teleprocessing network has been reduced significantly as a result of the GSA contract award from the federal government. By providing teleprocessing terminals in the individual districts, students will have access to the capabilities of the computer as well as staff members. Initially, we will be providing support for students to write programs and compile in BAL, PL/1, FORTRAN, or COBOL. This process will be carried on in a batch environment. The system will load student programs on a tape for evening processing and will return diagnostic print-outs the following morning. We anticipate minimal use of this service the first year, but do expect that this capability will play a major role in determining the future uses of the system.

The job of the "local district coordinator" may well be the most important role of all to the ultimate success of the project. The coordinators themselves serve as the pipeline of involvement for local educators with the OTIS effort. Working in parallel with the coordinators, the OTIS staff regularly visits and participates in meetings with superintendents, principals, counselors, business managers, and school boards. Our biggest job is in articulating the potential of the computer to Oregon educators and alleviating their natural fears and concerns. Local schools that are participating with OTIS during the initial wave realize that they must be able to clearly define their problems before either coordinators or OTIS staff can help them design a satisfactory solution. They realize also that the procedures which our staff or the coordinators may develop will not necessarily meet their own desires. We, therefore, stress to them the importance of understanding in detail the various steps they want involved in any data that is processed for their district so that they can affect the final designs. All of the data accepted by OTIS for processing requires complete documentation as to use and code. Procedural flowcharts, report formats, anticipated uses, and narrative descriptions must be completed prior to storage in the system.

Our experience to date indicates that this approach to developing an information system has been well founded. Our educators are enthusiastically involved in the development of their designs. I cannot overemphasize the importance that we, as a staff, place upon involvement with the coordinators. We feel that the environment which we are establishing will serve as a living, dynamic laboratory for the development of educational information systems. We believe that educators will not only be able to solve these problems, but will also be able to recognize true capabilities of computer systems. This laboratory environment will lend itself to the development of computer uses for local school districts that have never before been considered.

Beginning July 1, 1968, Project OTIS will be providing services with the scope comparable to any existent in the United States for elementary and secondary schools. The merits in developing a generalized educational information system with strong educator involvment will be tested. Oregon schools will learn to define problems and will be using the system to help in solving those problems. We believe that educators across the country, given the opportunity, can and will become strong members of the teams working to develop educational information systems for the 1980's.

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INSTRUCTIONAL PROCEDURES AND MEDIA--THE "IN-SCHOOL" VEHICLES FOR THE 70'S

by Gabriel D. Ofiesh

Probably the most significant development in the last few years, which is likely to become a critical element in the new education for the 70's is the emergence of instructional systems technology. It is through instructional systems technology that we are likely to engineer and mass-produce those project learning systems which will make the best possible learning experiences available to all students wherever they are and whenever they need them.

If individualized learning is to become as common as lock-step instruction is today, then a great deal still has to be done to develop the process necessary. The process needed must be an integral part of the so-called "systems approach" to education.

The systems approach is defined as setting forth pre-determined educational objectives and combining the techniques of system analysis, learning theory and instructional technology to develop and implement those learning systems which are validated and demonstrated to be maximally efficient and effective before their being used in a given instructional setting.

Not only must the learning systems be individually oriented by providing for self-pacing, they also must be self adaptive. The learning systems will have to contain extreme flexibility in the use and sequencing of instructional materials, aids, and media.

It is only when such models evolve that we will be on our way to developing a viable science of education. Now, the science of education will be dependent on development of a technology of education.

Technology is the application of science to art. Therefore it is a mistake to consider that Educational Technology is only concerned with instrumentation technology. We are talking equally of communications technology and above all of behavioral technology.

The potential inherent in behavioral technology gives us the first realistic hope of developing a "science of education". A science of human behavior in the full meaning of the term allows us to conceive of the possibilities of a science of education and a science of personality management. Behaviorism allows us to be truly process-oriented in education. If we do not develop a science of education or personality management, I do not know what our alternative will be. Behaviorism and its correlative educational process disturbs what I would like to call, the "mystique" of both teaching and media.

I have had the feeling that some people think if you take a single concept film, an overhead projector, a 35mm slide projector or maybe two or three of them, a 16mm film, a dial-access system, a computer, and a teacher, and you somehow tie them all together with a bunch of cords, that you now have a multi-media system. Well, you do; you have a multi-media system. But often that's all you have. That doesn't say you have an effective multi-media system or necessarily an effective instructional or learning system. This is the problem that mustconcern us. An effective media-based learning system is a highly engineered package requiring a great amount of craftmanship. It is far from enough to ingeniously relate media to each other. What is required is much more than creative conceptions and aesthetically pleasing products.

In the design and development of media-based instructional systems we have lacked that sense of process which the experimental analyses school of behaviorism could provide us. It was Alfred North Whitehead who pointed out that our age was characterized by a "perfection of means and a confusion of goals." This may be so; we could say, however, that modern education is characterized by a confusion of both means and goals. At a recent meeting of the American Psychological Association, B.F. Skinner was asked by someone what he thought about Jerome Bruner's dictum that anything could be taught to anyone at any age level, in any intellectually honest manner. Skinner's profound answer was reported to be a slight shrug of the shoulders and the word, "How?" Our concern must be with the "how" of the educational revolution, with the "how" of educational technology, and the "how" of education itself.

It is significant to note with what success we have found the "how" of solving some of our other problems in this world. Recently I was asked to speak to a group of educators in one of our midwestern cities. I was met at the airport by a representative of the group and while waiting for my luggage I noted the most amazing vending machine I've ever seen in my life. There were 25 buttons on it. It took a few moments to jot down the variety of coffee and tea that I could get: black coffee, black coffee--no cream, average sugar, black coffee, no sugar, heavy cream, no--etc. I wish I had the list with me here. For idiosyncratic and rather gifted people, buttons number 24 and 25 provided chicken gumbo and vegetable soup. My educator friend was impressed with the fact that I was impressed, and he pointed out to me with great pride that they were installing similar machines in the secondary school cafeterias. It's interesting that we're more concerned about the kind of coffee our students drink so that we cater to individual tastes in this respect, yet all of them go into the same classroom and get the same cup of black coffee curriculum. If we're truly interested in the "how" of education, if we are truly interested in individualized learning, if we are truly interested in discovery learning, then we might ask how are we to design our instructional media to accomplish this task.

There's no question that we are all unique individuals living in our own perceived reality. We are all functional organisms with a different set of experimental backgrounds. The cognitive and the phenomenological psychologists have made their point. Now, I think the behaviorists could try to tell us how to penetrate each and every perceived reality.

We have not really had a science of education as yet. We have had to date only a very poor art of education. And even our media utilization has been only a very poor art. In rare instances, very rare, it has been an excellent art. On the other hand, if we look at the growth and emergence of any science--the empirically-based science of medicine, for example--we can note a parallel development for the emergence of a science of education, which, like medicine, will be rooted in pragmatism. In the area of medical research, we are producing quite outstanding results without any basic or underlying theoretical framework. In educational science we must begin very much like Benjamin Franklin, and later like Edison who searched diligently in his laboratory for the one filament that would glow. I think he experimented with several hundred before he found one that would. With very little theory, medical science has been extremely productive. Horizons seem to be unlimited. Using the S - R model we may anticipate that a science of education will be empirically-based long before it will be theoretically so. Many ingenious and creative ideas need to be put to test in the living laboratory, namely our schoolrooms.

We need "wind tunnel" schools for our experiments. Until education and its correlative pedagogy develop a scientifically-based technology rooted primarily in behavioral technology, education will not become a profession--let alone a science. And if our educators aren't professionals, where does this leave the media people, and others who are developing in-school procedures? Unless the efforts of educators and media personnel are to be predicted on the qualities of a scientific enterprise and pedagogy, and media utilization ceases to be an art--the effort required to produce the quantum jump forward in educational process--so desperately needed--is not likely to occur. A breakthrough will only be possible in those areas where research and development efforts can be rigorously applied. The behaviorist provides the process of education - not the goals.

Another dimension that is provided by the Skinner experimental analysis school and other behaviorists is to subject the pedagogical competencies of the teacher, the stimuli configurations, the sequencing of subject-matter content, and numerous other software (message design) considerations, to tested empirical validation.

The only criterion that is acceptable is the observable change in the performance or behavior of students. The behavior of students--if you do not like the word "performance"--is the way they function, the manner in which they function, how they act, how they feel (and feeling is behavior), what problems they solve, what types of contingencies they resolve, what discriminations they make, what approach or avoidance behaviors they evidence, etc.

Either learning theory, educational psychology and educational research have been almost completely unproductive in their contribution to educational technology, or there has been an unwillingness to test the laboratory-generated ideas in our "wind tunnel" of schools. A critical survey of the American educational spectrum will not reveal any pervasive movement or comprehensive educational practice, which can be traced to the deliberations of learning and/or educational psychologists. Little in American educational practice can be traced to extrapolations from the laboratories of educators or behavioral scientists or educational psychologists. And the exceptions that come to your mind to disprove this generalization are only the exceptions that prove the rule. It takes many, many swallows to make a summer, and we are still deep in our winter of sad discontent.

To complicate matters and make them more difficult we may note that there is little in educational theory to guide us. The psychology of learning, as pointed out by Arthur Melton, is marked by great gaps and theoretical controversies. There is a lack of scientific information about learning that results in a serious division of opinion on just how ready psychologists are to offer help to the educational practitioner--namely, the school administrator and teacher. If learning-theory oriented psychologists are not prepared to offer help, then possibly educators have to produce their own guidance out of the founts of their own imaginations. Arthur Melton goes on to point out that while there have been impressive advances in the study of human behavior, "and especially of our understanding of learning process in the last twenty years, the fact remains that there is no unified science of learning." And this makes application difficult.

We might note, however, that science does not customarily mature by proceeding in a linear path, from the laboratory to the operational or applied circumstance. It may be--if the educational practitioner is imaginative enough--that we will elicit certain phenomena in our classrooms which the psychologist will then be unable to explain. There have been a few successful learning experiences which have defied theoretical explanations. It is often much later that theory supports reality.

William Estes in his "Review of Learning" for the Educational Encyclopedia offered very little in the way of real comfort for educators when he said, "There is no convergence imminent between the educators and the laboratory scientist's approach to learning."

In 1954, the late Donald Snygg said, "The sad truth is that after fifty years of careful and honest and occasionally brilliant research on the nature of learning, the only people who can be proved to have received any practical benefits from learning theory are the learning theorists themselves." He went on to describe the complexities of learning theory that make it useless to educators, and he compared learning theorists to the shipwrecked Scotsmen who made a good living by taking in each other's washing.

Regardless of the nature and extent of learning theory research and the number of direct applications of the results of research to educational training problems, some new perspectives are emerging. A few new methods and techniques have evolved as a result of some new knowledge. We have learned some things: pedagogical insights have evolved--not very much but some--from our use of new media. We need much more than good journals and good articles on excellent research efforts. We desperately need a national commitment to learning, an awareness of what is truly possible, and the research and development effort necessary to support it. Where the Office of Education is failing us, where the national foundations and national government agencies are failing us, and where we are failing ourselves in education, is in developing the "Manhatten projects" of the program to bring such incipient efforts to fruition. Until this is accomplished, the educational explosion needed in our society will not happen.

Robert Hutchins has stated that the first question a university should ask itself is, "What is it we are trying to do?" We need to know, first of all, what it is we are trying to do.

On the other hand, I do not think that the nature of his expertise in communication, behavioral and instrumentation technology provides a sanction for the educational technologist to determine for our society what it is we are supposed to do. We all have the right to involve ourselves as intelligent laymen and citizens in the goals of education, and specifically in the content of curriculum. It is just that our expertise in communications and behavioral technology and process, our competency in audio-visual message design, our knowledge of mediation mechanisms--these competencies in and of themselves do not qualify us as subject matter or educational goal experts. At the same time, there should be no doubt that we ought to be involved in the decision-making process as to what it is we are trying to do. Our question is: What is to be the actual nature of our involvement? We must encourage and, at times, force those who are trying to do whatever it is they're trying to do, to clarify precisely what it is they're trying to do. If we fail to do this we will give up our leadership by default and lack of involvement. One of the cardinal principles in the emergence of educational science, is the necessity, the sheer necessity for us to analyze and determine systematically and empirically what it is we're trying to do.

It is the reluctance of the leaders of the educational establishment to involve themselves in what it is that we can do with a science of education, that is preventing the emergence of educational innovation. This default is preventing the kind of commitment that is so desperately needed. Commitment will follow when we think that action is possible. We don't really believe it's possible, that is why there is not likely to be a science of education--unless the chaos all around us forces us to develop one. At the present rate, our communications technology will be used for other goals and other purposes. Radical educational innovations must take place which will allow education to emerge as a true profession with a scientific technology to support it. The media of tomorrow will carry effective messages which will elicit predictable modifications in human behavior. These messages will be designed by individuals who have a commitment to their goals. Whether or not they will be desirable goals remains to be seen. The gap between technological developments in our society and educational technology has, in all probability, fallen behind the point of recovery. This is not to imply that we have not had any progress. We have. But we're still "running twice as fast to stand still."

The fact remains though that no revolutionary breakthrough has occurred in the processes of learning. No radical advances have been made in instructional theory, methods, or in development of procedures by which people can learn more rapidly and more effectively. Not one of the developments in technology--from closed-circuit and educational television through teaching machines and other multi-media devices to computer assisted learning has had a singular pervasive impact on the education and training spectrum itself. If we have a thriving, robust educational science, then this will lead us to develop new, effective, efficient learning systems that can be packaged, and will enable us to transmit learning configurations to wherever the student is, whenever he needs it and can use it.

We have wasted too much time concerning ourselves with the wrong problems and the wrong questions. Our problems are the problems of message design. Our problems are problems of mediation not media! There is a difference. Our problems are problems of effective sequencing, of learning settings, of message design, and the design of appropriate stimulus-modes and response-modes, the proper use of animation, color, simple line drawings, compressed speech, realistic pictures, etc., etc. The S - R model is still a model that we can use, even though it is not the complete model for some of our problems.

We must package effective messages. We have developed a great deal of sophistication in instrumentation technology. We remain very primitive, however, in our software sophistication on learning process technology. Our academic discussions about the appropriate role of the teacher will make no contribution to meeting the immediate problems of 250 million children--ages 5 to 14--in the developing nations of the world in which the free world has a vital interest. While I am writing, these children do not have any schooling whatsoever. To be completely candid, I cannot get too excited about teacher-role discussions when we are faced with that possibility.

We have no real commitment to the possibilities of the new education as a nation. (Regardless of all that has been beautifully written and eloquently said.) We are a nation that is putting nearly three billion dollars a month into the Vietnam war and forty billion dollars into getting a man on the moon by 1970, and I just read in the paper this morning where our Congress has decreased the appropriation for the National Teacher Corps from the recommended thirty-three million to eighteen million dollars--twenty percent of our daily financial budget for Vietnam.

We are a society that will allow one headache tablet company to put eighty-nine million dollars in the commercial programming of one fifty-second TV commercial for eight years. However, we are also a society that receives from the bountiful table of government that small crumb of nine million dollars for public television, eight million of which will likely be foolishly spent. This is a society which spends more in one week in the programming of our three major television networks than we do in the programming of all our educational TV channels in one year, while deliberating how it is going to call back the paltry appropriations now allotted to educational research and development. Without the kind of financial commitment that is now going into other national enterprises--worthy or not as they may be--there will be no science of education.

But there will be communications science and technology. This technology is being used effectively today by many who probably understand the behavioristic frame of reference better than the behaviorists do. For example, as many as 94 percent of our homes have commercial TV sets in them. More homes have commercial TV sets than have bathtubs, and the commercial boys are getting their message across most effectively to our children and adults, in many ways, without their conscious awareness. Many commercial TV messages embody in their design the effective application of the principles of programmed education. Is this meaningful to us?

I would like to emphasize that by programmed education I am not talking solely of dull programmed texts. I am referring to something much broader in its implication. Through programmed education and programmed instruction technology, we have taken hold of a process which may give us the basic parameters for developing truly effective message design that can be transmitted through our various communication media.

Now, I'm not, as some of my friends think, redefining programmed instruction. It's there in literature for anyone to look at. Because programmed instruction is not solely a programmed text, I take serious exception to placing it in the list of aids to learning or with other media. It's not a media. It's no more a media than the principles of aero-dynamics are aircraft. The same principles of aero-dynamics supported the Wright Brother's first airplane's successful 30-second flight, as supported the flight of the Gemini aero-space mission. Programmed education has provided us with an opportunity to identify the "aero-dynamic principle" of learning and teaching.

I would like to close my comments with a charge. We are, I repeat, losing our leadership by default, and I am most concerned. Those of us who have a humanistic perspective on life have too often felt that technology is our natural enemy. I am concerned that Walden Two might become a reality. We have not recognized that the technology underlying Walden Two can be put to work to develop a different kind of man than we will get out of Walden Two. Dr. David Krech, at a meeting of the American Association for the Advancement of Science two years ago, in sober tones warned of the emergence of behavior and mind control in our society. This nationally recognized, conservative-minded, social psychologist stated that it is not yet here but it is coming--the scientific control of the human mind. Dr. Krech mapped out for his listeners this perilous achievement. The road, Dr. Krech said is the familiar one marked by the sign "knowledge is power." "For the first time," he warned, "bio-chemists, pharmacologists, geneticians, anatomists and psychologists"--but please note he didn't say educators and media specialists--"have been banding together in an effort to understand the operations of the brain. And this has happened with unprecedented speed." Other papers delivered at the same meeting bore out Dr. Krech's prediction of imminent knowledge of and therefore control over man's behavior. Scientists reported to their colleagues on drugs to destroy and improve the memory, on electronic control of the emotions through electrodes implanted in the brain, and on the many potential controls of the learning process--all well past theory and laboratory experimentation. Dr. Krech called for, and I think we should all call for, an advance consideration of the ethical, political and social problems that may arise from this knowledge. As a professional he is interested that his profession be saved from the dilemma of the atomic scientists after Hiroshima, "foolishly surprised, naively perplexed, and touchingly disturbed with their publicly displayed guilt at what they had wrought." Let us recognize, however, that much more is at issue than the embarrassment of a profession, whether it be Dr. Krech's or ours. The possible effects of these impending scientific discoveries are at least as far reaching and appalling as those of nuclear fission, and open up vistas of overwhelming horror. Such behavior and mind control will have profound effects on the administration of justice, on psychological warfare, on education, on medicine, and on interpersonal relations. These developments should receive full public discussion before they materialize. But without doubt, they should also receive our whole-hearted involvement. Once again, to paraphrase someone, a scientific advance is much too important to be left entirely in the hands of scientists.

CONFIDENTIALITY AND EDUCATIONAL INFORMATION

Excerpts from the opening remarks of Arthur S. Flemming

I am very happy to represent the University of Oregon and I'd like to say first of all that we are glad to have the privilege of serving as a joint sponsor with the Office of Naval Research on this Conference on the Requirements of Educational Information Systems. Soon after World War II it was my privilege to become a member of an advisory committee to Dr. Waterman who was then heading up the Office of Naval Research. I was very much impressed with the vision which was reflected in research planning within the Department of Navy. Consequently, I am not at all surprised that the Office of Naval Research is sponsoring this conference. I think all of us in the field of education and this country generally should feel very much indebted to the Office of Naval Research for the way in which they have approached and taken advantage of their research opportunities. I have a genuine respect for the standards of performance that it has set for itself in this area.

I read some of the papers that you are going to consider, and I have had two reactions. First of all I feel that the magnitude of the task which those of us in the field of education as well as in other walks of life should undertake is indeed an overwhelming one, and at the same time, I am more convinced than ever that it is imperative for us to undertake the task and to do so with a sense of urgency. I will comment briefly on some of the issues that have been identified in these papers including the one to which Dr. Loughary referred, which is of special interest to me.

Relevant Instruction

The first thing on which I would like to comment is the paper by Mr. Esbensen which places a great deal of emphasis on the desirability and necessity of our doing a better job in establishing performance objectives in the field of education. As some around this table know, I have long had the feeling that one of the most neglected processes in the field of administration is this process of defining or redefining our objectives. In the first place we seldom feel that we have enough time to make our objectives clear in writing. Even when we are willing to take the time to work on a definition or redefinition of our objectives, so often we do a poor job. We suddenly discover that it isn't an easy thing to define objectives in such a way as to be meaningful for the members of an organization. Finding it difficult to do, we are inclined to find reasons why we really can't spend a great deal of time working at defining objectives.

Let me say that I personally am stimulated by this particular approach to the establishment of performance objectives in the field of education. I can see where it would take a good deal of time on the part of a group to determine objectives of this nature. I can also see where if that time were taken, it would be a tremendous help to members of a faculty. Certainly it would be a tremendous help to administrators. But I think even more important it would be of tremendous help to the learner because it would provide him with a much clearer picture as to what is expected of him than the one we give at the present time. The time that it would take to do this would seem to me to represent time well invested. In the long run we would gain by that investment of time.

It seems to me that this paper with the emphasis on performance objectives is very closely related to a theme which runs through most of the papers I have had an opportunity to read. Namely, the emphasis on individualized instruction. I liked the contrast between individualized instruction and independent study which Dr. Loughary makes in his paper because we tend to use these words interchangeably, and I agree that this is unfortunate. As I read all of these papers, I began to see that at a time when there are a great many forces that appear to be operating to pull us away from the concept of individualized instruction, there are also forces at work which could bring us into a new era as far as individualized instruction is concerned.

One of the most baffling problems which confronts us in the field of higher education is that fact that we have forces at work in our institutions of higher learning that are certainly pulling us away from this concept of individualized instruction. Take, for example, the situation that confronts us in the area of liberal arts in education. The requirements for a major in a typical department in a college of liberal arts today are geared almost exclusively to the needs of the student who is going to pursue graduate work in that particular area. Yet, at the University of Oregon, for example, there are literally thousands of students enrolled in our college of liberal arts and majoring in particular subject matter areas who have no intention of pursuing graduate work in the respective areas.

Now it seems to me that this is a far cry from the concept of individualized instruction. The result is that we have a great many undergraduate students pursuing work towards an undergraduate degree with a real sense of frustration - with a real conviction on their part that what they are doing is not related to their individual needs. I think this is a very pronounced trend. It is my observation that we are not doing a great deal about it. The trend is being accelerated rather than being recognized as a problem which we should deal with in an effective manner.

There are some things going on that are helpful. The interdisciplinary measure is designed to offset this particular trend. At the University of Oregon we have decided to try to offset it in at least one broad area by establishing a new school - the School of Public Service and Community Affairs. This school is being established with the needs in mind primarily of the undergraduate student. We are thinking in terms of what kind of opportunities should be provided the undergraduate student who is looking forward to becoming involved in community service occupations or public affairs occupations. We think that this will result in quite a different type of educational program than what is followed today by the major in sociology or political science for example. At the present time, if an undergraduate student is motivated in the direction of a community service or public affairs occupation, he typically will either major in sociology or political science. As far as the University of Oregon is concerned, if he majors in political science, he is going to complete requirements which are geared to the students who are going to pursue graduate work in political science. Now I think our political science department is a strong department, and I think they are providing excellent preparation for the student who is looking forward to graduate work in that area. Nevertheless, they are not meeting the needs of the student, who after he obtains his undergraduate degree is looking forward to becoming involved in the service of federal, state or municipal government. I think the same can be said as far as the major in sociology is concerned. So I am very much impressed with this constant referral to individualized instruction. I recognize its important relationship to the topic of this conference, and I recognize that really we are at a point where we could make this concept of individualized instruction a reality, provided we can attain a position in which we can take full advantage of the resources that are available right now. To me, it is baffling and at the same time, exciting and challenging in every sense of the word.

Continuing Education

The next theme that I identified running through a number of the papers - there is one paper that deals with it specifically - is that of continuing education. For example, Dr. Loughary in his paper talks about an increasing number of people who hold a job for purposes of earning a living, an increasing number of people who will engage in recreational or avocational activities in order to relax and have fun, and an increasing number, and this is the group in which I am particularly interested, who will carry on serious work behavior of a more complex nature than their job in order to achieve a sense of purpose and worth. As far as our society is concerned, there isn't any doubt in my mind that we have reached this point. There is no question that what we think of as a basic work week will decrease, and I think by and large a person will have the opportunity of earning a reasonably good living by taking a job which calls for the expenditure of 30 to 33 hours of work per week. But they are not going to be satisfied by any means after they have completed that work week.

There has been a period when we said the person's remaining waking hours will then be occupied with recreation or leisure time activities of one kind or another. I am sure that many persons are going to spend a great deal of their time with activities of this kind, and that this does provide society with a very constructive opportunity. At the same time, I am convinced that there is going to be an increasing number of persons who are going to feel that after their work and after recreation and leisure activities, there is still a contribution they want to make to life.

This brings me back by [illegible] of illustration to the School of Community Service and Public Affairs. I do not think there has ever been a time when we have had more people in our community who are motivated to participate in community service types of activities on a full-time basis. That is, they would like to make it their life work, but others are anxious to do it as volunteers. At the same time, the latter are very conscious of their own inadequacies and as a result they hesitate to volunteer; some do volunteer and experience a great many frustrations simply because they are not well qualified to operate in these areas.

This certainly suggests certain responsibilities and obligations that confront the field of education in the area we now think of as continuing education. I was interested in Mr. Esbensen's comment that formal schooling should be attempting to develop human beings who will become competent, life-long learners, and I think this is a sound objective. It is an objective that we certailly have not achieved up to the present time. In spite of these opportunities, as Dr. Molinaro points out, the field of education, and particularly, the field of higher education, has failed to make a serious commitment to continuing education. My feeling is (this is a generalization, I know there are many exceptions) that if you take the field of higher education in general, that it is not an exaggeration to say that we have simply played at creating life-long learning programs. Every one of the papers that has been written for this conference cannot help but lead one to the conclusion that if we are going to do a better job as a society over a period of the next ten to twenty years, it is imperative for us to approach this area of continuing education with a sense of urgency.

Let me return to the community service area for illustration. Certainly in the last seven or eight years we have had more laws passed on the federal and state level eatablishing programs in the community service area than at any other time in our history. In addition, the legislative bodies have generally provided us with adequate funds to implement these programs. Time and again, however, we have found them impossible to implement because we haven't been able to recruit qualified personnel, and as a result, the programs have often fallen flat on their faces. The average citizen has reacted by saying the programs are unsound, instead of realizing that our real problem has been our inability to recruit qualified persons. We should take note of this situation and try to graduate undergraduate students who will be able to make a contribution in these areas in the years that lie ahead. We should consider it in work with graduate programs as well.

But what are we going to do over a period of the next five years? Are we going to continue to fiddle while Rome burns, or are we, as educational institutions, going to attempt to do a job of continuing education that will have the effect of raising the standards of performance in the community service area now? Is it impossible to achieve that kind of an objective? If it is impossible, then we can look forward to more riots and more reactions on the right claiming that the only way to deal with riots is to get tougher and tougher, and tougher. I am convinced the basic information is available. It can be utilized by educators in an effective way and thus can help increase the level of performance of our community service programs. However I am not at all convinced in my own mind that the field of education can do anything about it. That is an extreme statement. I am not at all convinced that what the field of education will do about it will have a significant impact on the country as a whole.

This really brings me to the next statement which I know is going to be under discussion, and I would like to underline it. This is what I like to think of as the administrator's information gap. Keith Goldhammer has developed that theme in his paper, just as I have heard him develop it on other occasions. I think it is Dr. Goldhammer's paper that deals with basic research and applied research, and the necessity for something in-between, which he refers to as development. Something like this is needed. If the educational institution as it stands today is going to deal effectively with the opportunities that exist in the area of continuing education, it will do so only because some administrators and faculty are ready and willing to establish breakthroughs and inaugurate and operate significant programs. Again, the information is available that would suggest to the administrator how he could go about responding to the challenge, and how he could get the support that he needs to implement these programs which would help education make a significant contribution to community service.

But how are you going to get that information to the administrators? I think there is a body of information which, if made available to the right people under the right conditions and in the right way, could produce action, but I have the feeling this isn't happening today. I wonder what we can do to correct the situation - not a year from now, but as soon as possible. I simply throw that out as an administrator who is somewhat baffled as far as this aspect of the matter is concerned.

I want to return more directly for a moment to continuing education. We have in Oregon, as you know, a State System of Higher Education. It is fair to say that none of the institutions in the State System of Higher Education have a commitment to the area of continuing education. I can give you reasons why they don't, but why bother about that. What I am interested in is how we change that situation and change it quickly. I am not at all optimistic at the moment. We have committees all over the lot dealing with it within our separate institutions and the Board Of Higher Education has a special committee of its own. How do you bring together the basic information bearing on this in such a way as to elicit action from the institutions that are a part of the State System of Higher Education in Oregon, and do so, let's say, by January or February of next year? I think this is illustrative of at least one of the concerns that is expressed in Dr. Goldhammer's paper. If I may stay with the community service area by way of example, information is available which could help break through this impass that we have in the area of continuing education. I am frank to say that I am not quite sure how you work with the educational community in a manner as to produce a fairly quick result in an area where we should have a very real sense of urgency.

I am in complete agreement with Dr. Goldhammer's thesis that we have passed the point where the educational community will tolerate what he refers to as 'maternalistic administration'. I doubt that it was ever a desirable state for the field of education, but it is perfectly clear that the educational community is not going to tolerate such administration, and I don't think it should, because I don't think maternalistic administration is capable of dealing with the kind of an opportunity that I have been talking about. But how do you operate in terms of what I would like to think of as consolidative management within the educational community and still get the kind of results that will make it possible for the field of education to render a service to society at a time when society desperately needs that service?

This very logically brings one to Dr. Gerard's paper on shaping the mind and the role of computers in education. May I say that I found this paper to be one that overwhelmed me, and yet at the same time, it left me with a feeling of hope. I share the conviction reflected in his paper that the computer can help us deal with some of the situations that I have been identifying, and deal with them in an effective and constructive manner. Again, I am wondering if the message of what the computer can do is going to be conveyed to the educational community in time for us to deal with some of these matters in a truly effective and constructive manner.

Information and Privacy

Now, on this question of privacy, I was very much interested in the provocative manner in which Dr. Gerard deals with this issue. I think that his section makes a very clear case for the need for some research in depth on this issue. If it doesn't take place, and we do not have the benefit of its results, it is certainly true that some very basic issues which confront us in this area are going to be decided on the basis of subjective judgment and hasty generalization. I was very much interested in his comment to the effect that we hear a great deal about individual rights and the infringement of privacy but very little of the advantages of the inevitable relinquishment of certain privileges as men crowd into social living.

One sentence certainly challenged me. It says that in any event technology in the behavioral sciences can be used with increasing power and reliability to reveal unacceptable attitudes and acts of individuals. Let me illustrate my own approach to this area by beginning with a comment regarding a development to which Dr. Loughary referred. When I came to the University about six years ago, I discovered that there had been rather sharp debate and conflict on the question of the kind of information that should be put into student personnel folders. The immediate issue had been resolved in what apparently was a satisfactory manner. But it was clear that the basic issue had not been resolved because people kept bringing up what I would think of as sub-issues, and asking for decisions on those sub-issues. As a result I asked our office of student affairs to begin work on a document which would clarify at least our thinking and our practices in this area. I thought such a document would give us the opportunity of looking at a good many issues within a frame of reference and would avoid our dealing with a multitude of fairly minor crises in this area. We made considerable progress in getting agreement on a document of this kind, at least as far as the student affairs staff was concerned. Some of us advanced the proposition that student records should be thought of as records that the instutution holds in trust for the student. We said that if we proceed from that premise, then the institution should reveal information in its records only when the student consented.

We have issued a document which is based on that particular premise. We will not reveal any information regarding a student unless the student consents to that action on our part. If we should have records subpoenaed, we are prepared to resist the subpoena on the grounds that this is our basic policy, and we feel that, with the policy in writing, if we should have to go to court we would have a good chance of making our position stick. The American Council on Education will soon distribute to all of its members a basic document that adheres very closely to the concept that I have just identified.

I feel rather keenly that this is a sound policy from the standpoint of protecting the student's right of privacy. I feel this as a result of the experiences I had as a member of the United States Civil Service Commission from 1939 - 1948. You will note that that carried me through the pre-war, the war, and the post-war period. I was called upon to read a good many files developed by the FBI, developed by investigators of the Civil Service Commission or investigators connected with the armed services. I can say unequivocally that the kind of information that colleges and universities had furnished to the FBI, Civil Service, and investigators of other agencies should never have been furnished. It constituted a serious violation of the right of privacy of the students.

Now, someone can say: shouldn't the right of privacy in an instance of this kind yield to the question of the security of our nation? I would make the generalized statement that it is possible for an institution to observe strictly this right of privacy without such a policy undermining in any sense at all the security of our nation. If you are going to establish the fact that a person is a security risk, you not only don't need the kind of information that comes out of personnel folders which are maintained by colleges and universities but I would contend that such information is very misleading in terms of arriving at a sound conclusion as to whether or not a person is in reality a security risk. I know that very often this invasion of the right of privacy is justified on the ground that an employer, public or private, needs this information in order to make a determination as to whether or not he is going to employ a person. First of all, I am not suggesting that the employer be denied all information of this type. I am suggesting that he have access to it only when the prospective employee is willing to grant him access to it. But in the second place, I have the feeling that there is a tendency in the direction of putting far too much reliance on the kind of information that you can get out of student personnel files, or the kind of information that you can get from questionnaires and tests that do impair the right of privacy. It seems to me that the employer should have the opportunity of determining whether or not the prospective employee has the necessary aptitudes and skills of performing the job he will perform if selected. The employee should expect that it will be necessary to it. But in the second place, I have the feeling that there is a tendency in the direction of putting far too much reliance on the kind of information that you can get out of student personnel files, or the kind of information that you can get from questionnaires and tests that do impair the right of privacy. It seems to me that the employer should have the opportunity of determining whether or not the prospective employee has the necessary aptitudes and skills of performing the job he will perform if selected. The employee should expect that it will be necessary for him to pass what could be referred to as a probationary period for new employees, and during that period the employer should determine on the basis of what would then be fairly objective evidence whether or not this is the kind of person he wants to continue to have in his employ.

Our difficulty is of course that we typically do not know how to use probationary periods in an effective manner. We are pretty sloppy about this. We don't set up standards of performance against which a person can be judged so that if we decide to act we can act and defend our action against criticism either on the part of the employee or others who may be interested in him. Let me make another statement, and again I go back primarily to my experience with the Civil Service Commission. It is almost impossible to make a fair and equitable judgment relative to what a prospective employee can do if we rely too heavily on the kind of information that oftentimes finds its way into student personnel files or similar files. My reason for saying that is this. Some of the students who are the most active activists during their undergraduate days are almost sure to put themselves in what a prospective employer would regard as a compromise position. Yet when we have the opportunity of following those students throughout their career in whatever areas they may be working, we often discover that some of the attitudes and points of view that they profess as undergraduates are anything but typical of their approach to life as they become involved in post-college responsibilities. And yet I know, to take one example, a competent, able young woman who had no opportunity of serving the government during World War II because when she was an undergraduate student at Vassar College she was very active in what later proved to be a Communist front type of student political organization.

This situation can be duplicated time and time again, and my fear is that we are moving into another period right now somewhat comparable to the McCarthy hearings.

I don't want the University of Oregon to be responsible for furnishing any information about the political affiliations of undergraduate students. It is none of our business, and we just have no intention of doing it. As far as lists are concerned, we have made it perfectly clear that we don't want to have on file any membership lists of any student organization. All we want to have is the name of the secretary of the organization so we can correspond with the organization if we need to. I don't want to have anything else on file.

Now, obviously the comments of Dr. Gerard in his paper are very relevant to this, and I may say that although I don't find myself in complete agreement with some of his statements, I am challenged by them, and I feel that they should be explored and examined, and they should be the concern of research. Let me give just one illustration. I noticed a review in Saturday Review on a book entitled The Spy in the Corporate Structure and the Right to Privacy by Edward Engberg. The reviewer has this to say: "The book effects an account of industrial snooping of all kinds, drawn chiefly from legal records, congressional investigations, and similar sources, and Engberg offers his comments, but for the most part these add up to viewing with alarm." "Then," says the reviewer, "Engberg's solution is a curious one to say the least. He recommends the establishment of a super information center under the auspices of the

National Library of Congress in Washington. Here information would be stored including tax returns, all census data, and just about everything else relating to each citizen. Any person could recieve a copy of his personal folder on payment of fee, others could see it only on production of a court order." Then the reviewer says, "But isn't there something ominous about this vast computer mausoleum storing data about every American? The cure would be far worse than the ailment--shades of 1984."

Now, I don't agree with the reviewer in this sense. He jumps to the conclusion that the establishment of such a center would necessarily jeopardize to a greater extent than it is jeopardizing at the present time the right of privacy. It is conceivable that centralization of data under strict controls and produced only on production of a court order might carry us further in the direction of protecting the right of privacy than we have yet achieved. This is suggested in a paper that is before you, and I think this should definitely be explored as a possibility. I can say I am a little skeptical because I have had some experience with the willingness on the part of government to make exceptions in terms of looking at our income tax returns, in terms of looking at information that is now compiled by the census bureau. After all, the centralized government that had the power to make that kind of an exception could probably convince us as individuals that we ought to do certain things if we knew the types of information in this central file. Now whether you can surround this with the kind of control that would prevent this kind of threat, I don't know. But I do think that it is definitely worth exploring.

Information and Survival

Let me make just one other comment. Again I think it was Dr. Loughary in his paper, who included this statement: "Personal and national survival will require, if not a world citizenship perspective, at least an awareness of world conditions and an elimination of the traditional provincialism of education." I happened to read at about the same time I was reading these papers, the full text of the address that Justice Goldberg, our Ambassador to the United Nations, delivered to the School of International Affairs at Columbia University in May of last year. (1) I want to quote from it briefly. I commend it to you because it seems to me that it very clearly points up our failure to use in an effective and meaningful way in the educational process the information that is available in the whole international area. In his address he refers to the fact that one distinguished critic identified what is going on in the world and in our own nation today as a withdrawl of legal order, and Justice Goldberg in effect takes issue with this approach. He says, "With these thoughts in mind, I now turn to the contention of the distinguished critic just referred to that there has been a withdrawl of legal order in this choatic and revolutionary age. He said, 'The first example given is the inadequacy of the police forces to solve the problem of crime and violence in our cities.'" (Now remember that this was written or delivered in May of 1966.) To continue:

> This argument, if I may say so contradicts itself for good law as we have seen does not manifest itself solely in police forces and jails, but also in just and equitable provision of the righting of wrong. Any judge knows that the great majority of juvenile crimes are committed not by spoiled children of rich or middle class parents, but the young victims of long-standing and deep-rooted evils: poverty, racial discrimination and the rejection of society's values that these conditions so often breed. Any prison warden in a big city knows how

> high a proportion of his cells are filled with the poor, semi-literate youths of our racial ghettos. These evils were not all created yesterday; they will not all be cured tomorrow; and even when they are cured the destructive attitudes they have generated are likely to persist for years. In the backlots of city slums we are reaping the weeds that have germinated during generations of complacent neglect.

The second illustration used was in the field of labor management relations, and I am sure you have some idea how he may have dealt with that, and then he went on to say these domestic examples contain clues to the nature and value of law among nations.

> First, good law involves the necessary minimum of coercion, and a maximum of affirmative, creative action--political, social, and economic--to correct the wrongs that underlie much of the violent conflict of our times. Second, where disputes threaten to get out of hand and injure the entire community, the community must possess the machinery to contain the dispute and prevent the injury.
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> When we study the functions of law among nations, we find both these propositions repeated on a larger scale. The international institutions that exist to give effect to them are much weaker and less cohesive than those of a national government. But we cannot afford not to use them to the fullest, because the consequences of international war under modern circumstances, are even more unacceptable than those of civil insurrection. Our hope for world peace depends on our ability to extend to the international sphere a dual concept of law, both creative and coercive.

A good portion of this address has been devoted to an identification of the progress that we have made along this line in the international field. The typical undergraduate coming out of our college or university, the typical citizen, if you talk to him about the rule of law in the unruly world, will probably indulge in a generalization such as, 'well, we really don't have anything like law in the international world.' He has no understanding or comprehension of the progress that society has made - the very loose comparisons that are made between the United Nations as it stands at the present time, and the old League of Nations is a perfect illustration of this - of assuming there is evidence pointing to the fact that the United Nations is moving down the same road that the League of Nations moved down.

I served for a little better than a year as a member of the Commission on the University of World Affairs. It was a commission that was headed by Dr. Morrow, the former president of the University of Minnesota. I was then Secretary of HEW. Also on the commission were John Gardner, Dean Rusk, and the heads of three foundations among others. The thing that we tried to underline in our report was the almost complete failure on the part of our undergraduate institution to turn out graduating persons who had basic information relative to the whole field of international affairs. If you think of the typical undergraduate student and the typical program that he follows, you will have to conclude that this was probably a point worth underlining. I would say that if you gave an elementary test calling simply for a knowledge of basic information relative to the field of international affairs to a graduating senior class of a college or university, at least 75% of them would fails the test. I don't think there is any question about it at all. We are in a position where it is becoming increasingly clear that if we are going to avoid nuclear warfare, we must substitute international judgments for unilateral judgments. We haven't got a citizenry that is at all conditioned to that kind of evolution at the present time, but the thing that underlined this for me was the very effective way in which Ambassador Goldberg identified some of the progress that has been made.

I think basically we are pessimists as far as the whole field of international affiars is concerned, and there is reason for our pessimism. But it would be a more balanced type of pessimism at least if we had an understanding as to what is really happening in the field of international affairs. Here there is a whole area of information available. Methods of pulling it together and presenting it in a meaningful and effective manner are available, but really we are not doing anything about it in our colleges and universities. Frankly, I think that our secondary schools do a better job than our colleges and universities do. The fact of the matter is that a high school senior could probably do a better job on the kind of test that I suggested at the time he graduates from high school than he could do after he graduated from college, because we do have programs in the high school that certainly make the high school senior more aware of what is happening in the field of international affairs than is the typical college senior. He gets to college and just loses contact completely. He may get into a course in international affairs, but out of the thousands of students that graduate every year, it is a very small percentage that would get into such a course. Some would get into other courses where there would be some reference to this, but it will be a very, very small percentage.

Let me conclude with a final example. We have a treaty that is going to be presented to the Senate within a few days dealing with our relations with Panama and it is a treaty where the United States is giving up something in the interest of protecting the integrity of Panama as a nation. You have seen the stories. A Chicago paper acquired a copy of it and printed a misleading story, i.e. displayed inaccurate, biased information. We now have better than a hundred members of Congress who have filed petitions and resolutions in the House of Representatives urging that our country not ratify this particular treaty. Fortunately, the House of Representatives doesn't have anything to do with its ratification, but they will have some impact on the members of the Senate, and I am told that if this treaty is not ratified, we will have an immediate break in diplomatic relations with Panama. We will have immediate institution of guerrilla warfare in that part of the world, which according to the Chairman of the Joint Chiefs of Staff will make the guerrilla warfare in Viet Nam look rather simple by comparison.

Educational information, whether it be formal or informal, as was the case in the example, is powerful. We must concern ourselves with it--so that it is used as a helpful rather than a destructive force.

References

(1) The Department of State Bulletin, Vol LIV, No. 1397, April 4, 1966, "The Rule of Law in an Unruly World", Arthur J. Goldberg, U.S. Representative to the United Nations, Adlai Stevenson Memorial Lecture at the School of International Affairs, Columbia University, New York, New York, May 18, 1965, pp. 936-944.